



The techno-finance fix: A critical analysis of international and regional environmental policy documents and their implications for planning



Trish Morgan*

National Institute for Regional and Spatial Analysis, Maynooth University, Co. Kildare, Ireland

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ABSTRACT

This article is concerned with the interaction of international, regional and national policy on climate change and sustainability, and the implications of these policy dimensions for planning. With the scientific consensus pointing to unequivocal human influence on the ecosystem, the issue of how best to manage climate change and ecological sustainability is arguably now a matter for economic, political, policy and planning domains. However, despite the warnings of scientists that 'business as usual' economic accumulation is no longer an option, this analysis of international and regional policy suggests that in the main, solutions are proffered that merely shift forms of capital accumulation and enforce 'business as usual', rather than providing transformative trajectories to plan for climate change adaptation and mitigation.

This article traces key documents from an international level including United Nations Framework Convention on Climate Change (UNFCCC) and Intergovernmental Panel on Climate Change (IPCC) reports, to EU regional policy, and sectoral policy at a sample national level. This is with a view to providing a theoretical backdrop, and a summary of selected relevant documentation that planners may be required to consider with respect to climate change issues. This article may therefore be considered in part, as a 'map' of the policy landscape for planners, highlighting the policy tensions and the conflicts that exist between international, regional and national levels of policymaking. These tensions largely lie between the areas of economic and ecological stability, and usually fail to reconcile contradictions between economic growth and protection of the ecosystem.

The article introduces the concept of the 'techno-finance fix' to analyse and critique the dominant solutions to climate change. These solutions involve a dovetailing of a hope in emergent, new and not-yet-existing technologies, with a hope that the markets will fund the correct types of technological innovation deemed necessary to mitigate climate change. Therefore, the implications for planning involve an imperative to respond to climate change, and knowledge in the key aspects of climate change policy. However, the response at a planning level depends on which dominant narratives are being forwarded from the top down at a multi-layered policy level. This work therefore suggests that the 'techno-finance fix' is a dominant approach to climate change mitigation and adaptation, and that planning for climate change is thus informed by this dominant narrative, to the marginalising of alternative solutions, including those outside the market or technology.

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1. Documents analysed and hierarchical structure proposed

1.1. Documents analysed

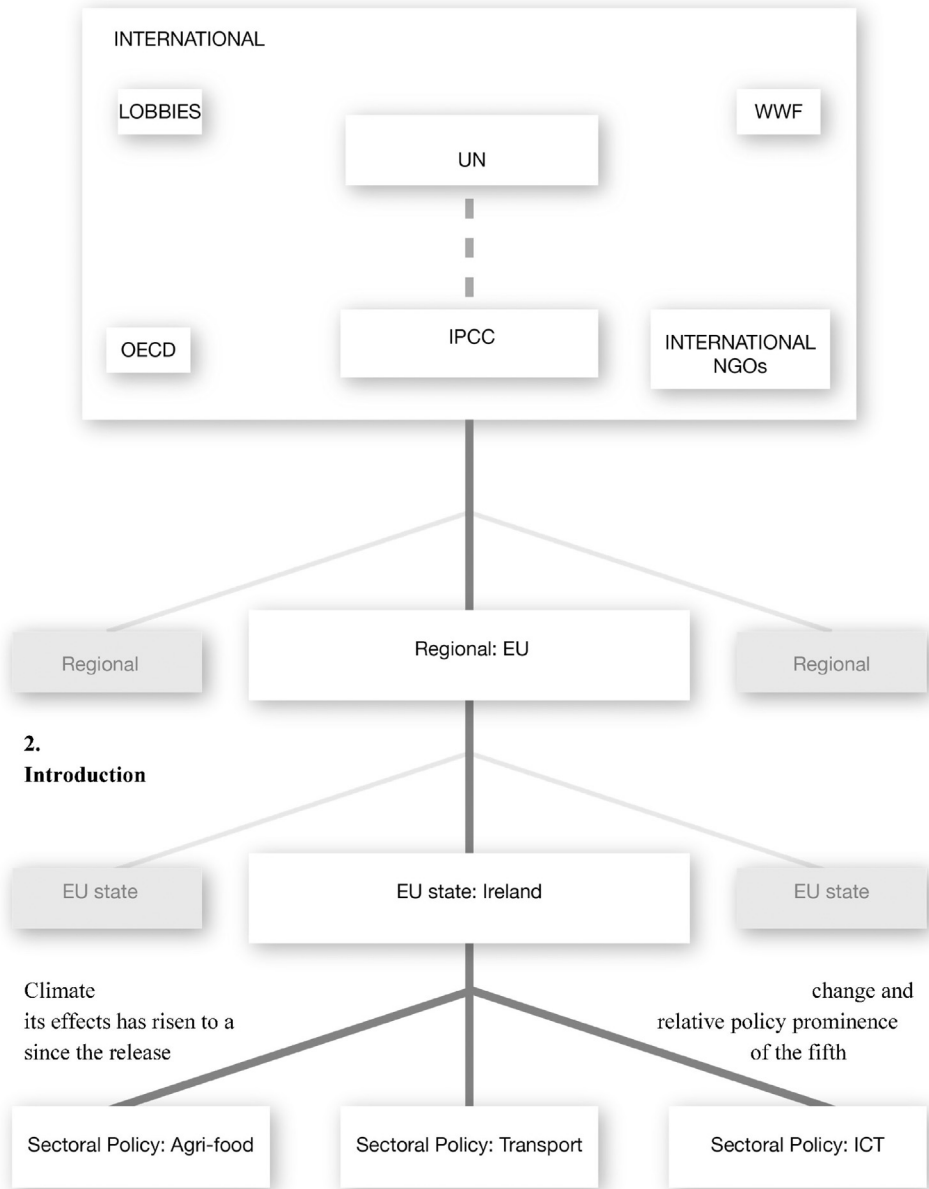
International	United Nations Framework Convention on Climate Change (1992)
	Fifth Assessment Report of the Intergovernmental Panel on Climate Change:
	Summary for Policymakers from Working groups I (2013), II (2014a), III (2014b)
	World Bank Turn Down the Heat:
	Why a 4 °C Warmer World Must Be Avoided (2012)

* Present address: School of Communications, Dublin City University, Glasnevin, Dublin 9, Ireland.

E-mail address: trish.morgan@nuim.ie (T. Morgan).

Regional: EU	Climate Extremes, Regional Impacts, and the Case for Resilience (2013) Confronting the New Climate Normal (2014) WWF Living Planet OECD Towards Green Growth (2011) United Nations Resilient People Resilient Planet (2012) Policies to Encourage Sustainable Consumption (European Commission/Bio Intelligence Service, 2012) 7th Environmental Action Plan titled Living Well Within the Limits of Our Planet (European Commission, 2013) EEA Signals (European Environment Agency, 2014) European Council Conclusions on 2030 Climate and Energy Policy Framework (2014)	Sectoral: Agri-food Transport ICT	Food Harvest 2020 (Department of Agriculture, Food and the Marine, 2010) Our Sustainable Future (Department of Environment, Community and Local Government, ND) Smarter Travel (Department of Transport, Tourism and Sport, 2009) Irish National Spatial Strategy Energy in Ireland 1990–2013 (Sustainable Energy Authority of Ireland, 2014)
	National: Ireland Climate Action and Low Carbon Development Bill 2015		

1.2. Hierarchical structure of proposed interplay of documents



2. Introduction

Climate change and its effects has risen to a relative policy prominence since the release of the fifth assessment report (AR5) of the Intergovernmental Panel on Climate Change (IPCC). Consensus is growing that economic 'business as usual' is not ecologically sustainable due to fossil fuel energy remaining dominant in production. The need to reduce carbon consumption globally by up to 70% by 2050 is seen as the only scenario in which there is a likelihood of keeping global temperature rise below 2 °C on pre-industrial levels (IPCC, 2014b, 12–13). This goal, according to the IPCC, is achievable with a combination of mitigation strategies and alternative energy mixes (IPCC, 2014a, 2014b). The minimal costs associated with acting in the short-term to start this mitigation, are however, set to increase as mitigation is delayed (IPCC, 2014a, 2014b; Stern, 2006). Thus, at a planning level, immediate action is required to strategically plan for both mitigation of greenhouse gas (GHG) emissions, and adaptation for the extent of climate change that has already taken place, which is, to date in excess of 1 °C above pre-industrial levels. This places the planning domain at the core of urgent climate change action.

In terms of political economy however, conflicting perspectives emerge on how to achieve emissions reduction targets, as the maintaining of the economic status quo has been the priority of international and regional actors. This is despite warnings about 'business as usual' issuing from the Stern Report (2006). The subsequent dovetailing of Stern into a neoliberal framing, where technical and market fixes were foregrounded as solutions, reveal that current economic arrangements are not best-placed to achieve necessary mitigation targets. Indeed, under this economic imperative, the relatively small costs of immediate mitigation take on a significance in a global economy that has been in crisis. This is a major critique of Stern, in that a report situated in terms of costs and benefits of climate change, cannot make comprehensive recommendations on meaningful action, whilst also being subject to the vagaries of the market (Spash, 2010; Smith, 2007a, 2007b). Thus, any policies related to climate mitigation or ecological sustainability, let alone the implementation of these policies through strategic and robust planning, are in tension with restoring growth. This is evident in the current energy landscape, where, due to a 'renaissance of coal', the most efficient energy has been in the form of coal-fired power. This has led to an increase in the rate of carbon emissions, as illustrated in a stark finding from the IPCC (IPCC, 2014b, p. 7). This finding reveals how despite an increase in binding treaties and policies connected with limiting emissions, not only have emissions continued, but the rate has increased from 1.3% growth up to about 2000, to 2.2% growth since 2000, pausing only briefly during the financial crisis in 2008–09.

Given this contradiction between the number of mitigation policies and the emissions rate increase, it becomes important to analyse policy in terms of assessing its ability to function as an effective tool for achieving the necessary targets to minimise climate disruption. The role of planning is also key here, as clearly there exists a mismatch between the goals of environmental policy to reduce carbon emissions, and the reality of the economic drivers of emissions. This analysis therefore examines selected policies at three spatial categories; the international, regional and national levels. This is in order to build a contextual understanding of tensions and conflicts between environmental policy and perceived economic imperatives. The international context for the purposes of this work includes major global actors such as the UN, the IPCC, the OECD and the World Bank. In the regional context, the region chosen for this analysis is the EU. The EU is a major world region, rather than a micro-region. It is a significant part of the industrialised world which historically industrialised on the basis of cheap availability of fossil fuels. It is therefore deemed one of the

world regions historically responsible for current levels of pollutants in the atmosphere, which now require international interventions to offset.

At the national level, Ireland has been chosen for analysis. Ireland is an example of a state within the EU that leans towards strong neoliberalism as its development strategy. This takes place in the context of its existence as a small, late-developing and geographically peripheral national setting. Therefore, whilst environmental policies can issue from EU, Ireland in general has relative autonomy to adapt the policy by ways deemed suitable for this setting, where development and spatial geography issues converge. In this instance, Ireland has chosen a policy of loose regulation and strong adherence to market strategies (Breathnach, 2010; Ó'Riain, 2014). This is also evidenced in terms of industrial policy where indigenous agriculture is prioritised for development along the lines of expansion and intensification, such as evidenced in the Food Harvest 2020 programme, discussed later. Aside from the aggressive growth policy evident in the policy for domestic agriculture, multinationals are prioritised for investment supports, and foreign direct investment is a policy holy grail.

A key factor for effective planning lies in how certain agendas can be more prominent than others at policy level at varying times (Princen, 2011, 2013). This in turn influences planning processes in terms of the conceptualisation of strategies to implement policy directives. For the purposes of our discussion, the issue of climate change previously became a priority at policy level after the release of the *An Inconvenient Truth* film in 2006, with director Al Gore and the IPCC jointly sharing a Nobel peace prize in 2007 for their contribution to the understanding of climate change (Princen, 2013, p. 191). However, the economic crisis that unfolded in 2008 has become a higher priority agenda item since then, relegating issues of planning for climate change to lesser political attention. It is seen as more urgent to stabilise the economy in the short-term than to divert apparently limited funds to climate change mitigation and sustainability strategies.

Therefore economic and ecological priorities exist in tension with each other at a policy level, with the economic agenda usually taking more priority than the environmental agenda (Princen, 2013, p. 203). However, significant events can move and change policy priorities. Such 'focusing events' (Kingdon, 2003, p. 94) are 'powerful because they put one particular (aspect of an) issue in the spotlight, while simultaneously detracting attention from other (aspects of) other issues' (Princen, 2013: p. 202). This article suggests that the IPCC AR5 report acts as such a focusing event. Yet its findings have emerged in a broader context that is mired and embedded in a paradigm of maintaining growth and accumulation, with the political economy of neoliberalism to the fore in economic, social and indeed, environmental decision making and planning.

This article thus situates selected environmental policymaking and planning in the context of that tension between neoliberal economics and ecological sustainability, revealing that even when ecological issues are to the fore, they are couched in economic terms. The implications for planning for climate change adaptation and mitigation are of great salience here, in that the 'menu' of strategies, options, and conceptual frameworks potentially becomes dominated by economic imperatives rather than long-term strategic planning efforts. The article introduces the concept of the 'techno-finance fix' with which to critique this dominance of economic reasoning around ecological crisis, including the financialisation of the overall global economy and, indeed, the ecosystem itself. The term also acknowledges how the financialised market is deemed an appropriate mechanism through which to fund the technologies cited as necessary for climate mitigation. Thus, the 'techno-finance fix' dominates to the potential exclusion of other social innovations, non-market solutions and broader

strategic planning efforts beyond technological offerings. The imperatives for planning therefore involve an awareness of the dominance of the ‘techno-finance fix’ and a vigilance around considering alternative paradigms beyond technology and finance. The article understands that the domain of planning encompasses myriad areas. However, when discussing issues pertaining to planning, it understands that a range of planning areas are involved, including environmental, economic, spatial and resource planning areas. Furthermore, it suggests that a ‘siloeing’ of policy enactments needs to be transcended in favour of strategic planning across areas of the planning domain.

3. Context of this article

This article is written firstly on the backdrop of the release of the fifth assessment report of the IPCC (IPCC AR5), which was released between 2013 and 2014. At the time, it was acknowledged that the subsequent conference of the parties (COP21), would be seminal to understanding the extent to which the message of the IPCC was to be translated by the members of the UN Framework Convention on Climate Change (UNFCCC) into actions and plans for adaptation and mitigation. Thus, for the purposes of this article, both the IPCC AR5 and the subsequent COP21 act as focusing points for the realpolitik of climate change, in the guise of the instigation of practical planning and policy measures needed for climate change action. This paper is therefore written and informed by the contexts of actually-existing climate change, and the current political responses emerging after the focusing moments of IPCC AR5 and COP21.

The context of this article also takes account of the history and political achievements of the COPs, which are varied and fraught. It was at COP3 that the Kyoto protocol on greenhouse gas emissions was adopted. This COP was therefore deemed a success. Other COPs, such as COP15 in Copenhagen were mired by disagreement and inaction. Thus, following on from the recent release of the IPCC AR5 reports, COP21 at Paris in November 2015 was seen as a key moment to secure international, meaningful and legally binding targets on mitigation of greenhouse gases, in order to ensure global warming remains at a level less than 2 °C. At first glance, the opportunity to secure meaningful and universal action was successfully realised at COP21. A binding agreement was reached by all 196 countries, to include not only an ambition to keep warming below 2 °C, but to have the ambition of keeping it to 1.5 °C.

However, once the initial hubris around the success of COP21 abated, more critical discourse emerged on the realpolitik of tackling climate change. The ‘binding’ agreement was overshadowed by the uncomfortable reality that the agreement was based on countries’ own voluntary commitments, known as Intended Nationally Determined Contributions (INDCs), which had been submitted in advance of the talks. These INDCs were therefore based on what the countries were prepared to commit to, rather than the international agreement holding countries to a robust commitment on emissions reduction. There is therefore a concern is that the ambitious target of 1.5 °C or even 2.0° warming is not likely to be met under the current INDCs.

Secondly, these INDCs are based on projections of the availability and effectiveness of new technologies that currently do not exist. BeCCS, or Bioenergy, Carbon Capture and Storage is the main suite of technologies advanced as a ‘fix’ that will not only reduce emissions, but facilitate negative emissions. Thus, countries are relying on a future technology fix rather than acting in the short term to reduce emissions. Indeed, given that the technologies are not actually existing, this article is critical for the hubris associated with them, when they do not even have the ‘temporary’ status as described of fixes in general. Rather, they are aspirational

technological dreamware that defer immediate and sustained action on emissions. Such ‘Dr Strangelove options’ have been criticised as previously ‘discussed only as last-ditch contingencies’ but they have now become ‘Plan A’ (Anderson, 2015, p. 437).

Furthermore, COP21 remains aspirational in terms of allocating financial measures to mitigate climate change and assistance with adaptation, with no ‘bankable commitment’ on the part of states (Wolf, 2015). Also disappointing, if not a direct avoidance of responsibility is the failure to include emissions from aviation and shipping in proposals to limit GHG emissions (Wolf, 2015). These ‘fuel bunkers’, or ‘non-sovereign emissions’, are not taken into account, yet they have increased from approximately 534 megatonnes of carbon dioxide in 1990, to 1079 in 2010 (Boyd, Turner, & Ward, 2015). The failure to include a growing emissions ‘bunker’ is of serious concern. The implications of this growth mean that the emissions targets for individual states are likely to be conservative and inadequate (Boyd et al., 2015).

Therefore, a critique of COP21 in terms of the realpolitik of climate change, is in the reliance on existing models of accumulation, technological fixes, and selective measurements of emissions. This cocktail of ‘fixes’, particularly in BeCCS, fosters the assumption that first world lifestyles, and the economic model that is based on accumulation, can continue (Anderson, 2015). The prioritising of the aspirational technological fix, or, as this article suggests the ‘dreamware fix’, is predicated on the assumption that a transition to a carbon-neutral capitalist economy is possible and indeed, the only viable way of responding to climate change. This green growth ‘dogma’ has, according to critique ‘quashed any voice with the audacity to suggest that the carbon budgets associated with 2 °C cannot be reconciled with the mantra of economic growth’ (Anderson, 2015, p. 437).

Such dogma or rhetoric is connected to concepts of resilience, which is seen in the planning context as a seductively unifying and useful concept with which to move the domain forward (Davoudi, 2012, p. 299). However, its concept is synonymous with maintaining the status quo, or maintaining as much structural (i.e. social, cultural but especially economic) stability as possible in the face of requirements of societies to adapt to climate change (Pelling, 2011). It is seen as ‘good’ to aspire to resilience (Davoudi, 2012, p. 299), implying that to be vulnerable to climate change is a collective weakness or failure to be avoided. This has implications for practical action on climate change at a planning level, in that a focus on resilience as a unifying strategy for planning allows the neoliberal status quo to continue. This is to the detriment of a critique of the existing system and the exploration of alternative, less wasteful and more equitable, paradigms (Davoudi, 2012; Pelling, 2011). Resilience is also overstated as an adaptation mechanism, assuming that ‘in this clockwork universe, a resilient system is one which may undergo significant fluctuation but still return to either the old or a new stable state’ (Davoudi, 2012, p. 301). Such ideological norms can suggest ‘that the government should retreat from its responsibilities; a favourable conclusion in the current neoliberal climate’ (Davoudi, 2012, p. 305).

Viewed through this critical lens, COP21 and its implications for future strategic planning, are locked in to this maintenance of the economic status quo. In such existing structures, climate adaptation can only happen through the perpetuation of the existing economic arrangements. Yet neoliberalism has made societies more vulnerable to crises of capital whilst the inequalities produced by the same system exacerbate ecological vulnerability (Harvey, 2010; Pelling, 2011). Therefore, there exists a contradiction in that climate change requires robust governance structures in order to have some hope of success with climate change mitigation. Yet, in the context of compromised democratic structures, the only option available seems to be the maintaining of existing economic arrangements and working around them

using techno-finance fixes, such as the aspirational technological dreamware seen in hopes pinned on BeCCS. Given this problematic context, we now move to some theoretical perspectives on growth and the role of ‘fixes’ in order to provide a critical perspective on the policy discourse.

4. Theoretical perspective 1—growth

4.1. Compound growth

The theoretical perspectives most useful for the purposes of this study of policy and its implications for planning, are those that take account of political economy and ecology. Such accounts acknowledge that continued compounding economic growth is a cause, if not an accelerant of climate change (Foster, 2013; Smith, 2007a; Urry, 2010). Amongst these theoretical perspectives there exists acknowledgement of the contradiction between a world economy that requires compounding growth to function, and the material and absolute limits of the planet and its ability to both produce and absorb the products of growth (Magdoff & Foster, 2011; Magdoff, 2013; WWF International, 2014). The financial crisis of 2008 was seen by some as an opportunity to temper the aggressive neoliberal policies that had seen not only increases in carbon emissions, but in increase in the rate of such emissions, at a time when more rules and regulatory barriers were supposedly in place to ameliorate if not the climatic but at the very least the carcinogenic effects of GHGs (IPCC, 2014b, p. 7). Thus, the ecological problem has become no longer as much a scientific issue as a political and economic one, given that despite the hopes for reflection on alternate economic formulations, the financial crisis did not precipitate an adjustment of the policies of growth, but rather enforced them (Castree, 2010; Harvey, 2010). We are thus arguably at a point where the needs of the economic system are at odds with the requirements for reduced growth and even downsizing of the economy for the sake of ecological sustainability. This is therefore a key tension and contradiction that is challenging in a planning perspective, as the pressures and imperatives to keep the economic system moving forward can stand at odds with ecological practices and principles.

Critics of the ‘business as usual’ economic position point to the tension and contradiction between the growth imperative of capitalist economies and the ecological limits of the planet, arguing that it is necessary to practice ‘degrowth’ or at least encourage a transition to a ‘steady state’ type of economy (Jackson, 2009; Ryan, 2009; Kubiszewski et al., 2013). However, the political economy perspective is often neglected in such discourse, with the accounts neglecting to acknowledge that this is a functional impossibility of capitalist economies. Harvey (2014) saliently outlines the issue. Fundamental to such economies is profit-making, which ‘requires the existence of more value at the end of the day than there was at the beginning’ that in turn requires ‘an expansion of the total output of social labour’ (Harvey, 2014, p. 232). Harvey is unequivocal in asserting that without such continuous expansion, no capital can be derived from economic processes. Thus, according to this account, ‘a zero-growth capitalist economy is a logical and exclusionary contradiction. It simply cannot exist’ (Harvey, 2014, p. 232). Indeed, if zero-growth occurs in a capitalist economy, such an economy is in crisis.

The in-built requirement for growth is evident in the work of Steffen et al. (2006) who illustrate graphically various indicators such as population, GDP, motor vehicles, energy consumption, nitrogen fixation, species extinctions and atmospheric CO₂ concentration, amongst others (Steffen et al., 2006, p. 5–6). Each of their findings shows not only an increase in these indicators but a compounding of the increase, where an inflexion point is reached and the trend continues upwards at an accelerating rate until the

trend is, literally, off the charts (Fig. 1). This reflects the long-term expansion of the global system of capital, which has hit an inflexion point in compound growth (Harvey, 2014, p. 253). This connection between exponentially growing economic and ecological indicators points to capital’s incremental and iterative influence on ecological processes. In capital’s requirement for expansion, the natural world itself is incorporated into the economy, where ‘even genetic identifications are now claimed as private property’ (Harvey, 2014, p. 253). Thus, ecological concerns are couched within economic paradigms, with a representative from the World Bank famously decreeing that Africa is ‘under-polluted’ (Foster, 1993), and where selective policies on which pollutants are acceptable or not, are all subject to market evaluation (Smith, 2007a, p. 10–11).

One logical solution is to mitigate the ecological crisis – of which climate change is just one of nine aspects – by dampening the production of surplus and its associated waste. This, as we have seen, is an impossibility under current economic conditions, in that ‘in a growth-based economy, growth is functional for stability. The capitalist model has no easy route to a steady-state position. Its natural dynamics push it towards one of two states: expansion or collapse’ (Jackson, 2009, p. 64). Capitalist economies are thus structurally unsuited to a steady state, let alone a downsizing of impacts on the ecosystem. At a policy level therefore, it becomes an imperative that growth is prioritised to prevent or mitigate economic crises, however at odds such policies are in terms of ecological stability. This pressure to maintain the system and prevent crisis is undoubtedly of importance for planning in terms of the portfolio of options or solutions that may be considered with respect to planning for climate change.

Indeed, ecological policy is enacted through financial instruments to ‘cap and trade’ carbon, with the EU having ‘traded environmental futures devoted to environmental hazards and pollutants’ (Smith, 2007b, p. 777). A critical appraisal of carbon futures schemes argues that carbon will not necessarily decline under such emissions trading schemes. Indeed, there is a danger that carbon trading can ‘actually create an incentive for pollution in some places insofar as a profit can be made’ (Smith, 2007b, p. 787). Likewise, as the average temperature rises under conditions of climate change, profits stand to be made in the area of weather futures and indeed extreme weather events such as hurricanes future markets (Smith, 2007b, p. 777). Therefore, financialisation is seen as a significant actor in mitigating climate change within the boundaries of already existing economic conditions, with little critique of how such financial instruments potentially add to the issues. This is the case even in the light of the market-driven

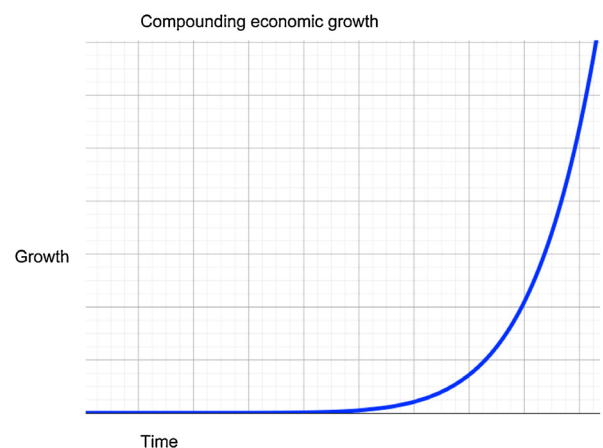


Fig. 1. Compounding growth over time. Ref: visualisation by author, based on Steffen et al. (2006) and Harvey (2014).

'renaissance of coal' identified by the IPCC. This article thus posits that financial instruments comprise one aspect of a 'fix' to climate change that promises to offer solutions to climate change without altering the economic status quo of compound economic growth. For strategic planning for climate change, this 'fix' acts more like a trap that potentially renders strategy hamstrung by requirements to leave the economic domain undisturbed, or, indeed, to actively participate in economic solutions only, whilst labouring under the misapprehension that there is no alternative to planning solutions that prioritise the economic status quo.

4.2. Growth and progress

A further critique of compounding economic growth is also in its erroneous association with happiness and wellbeing (Hamilton, 2003; Jackson, 2009; Sandel, 2013; Skidelsky & Skidelsky, 2013). This has manifold implications for the domain of planning, in that growth is purported to promise a future better life, indeed the idyllic 'good life' (Skidelsky & Skidelsky, 2013). From this ideological perspective, growth is equivalent to progress, and to critique the benefits of growth is deemed at best, regressive. Indeed, any questioning of the unilateral benefits of growth is 'deemed to be the act of lunatics, idealists, and revolutionaries' (Jackson, 2009, p. 14). Thus, for planning, with its *raison d'être* concerned with acting for the long-term strategic benefit of society, it is seductive to assume that growth is not only beneficial for society, but a necessary precondition for societal progress and wellbeing.

However, despite the raising of living standards that have been associated with growth, indicators of social progress, happiness and human flourishing have, at best remained level, if not decreased (Social Progress Imperative, 2015). Rather than bringing social progress, economic growth without care to social conditions merely 'fosters empty consumerism, degrades the natural environment, weakens social cohesion and corrodes character' (Hamilton, 2003, p. x). The neoliberal era has allowed markets to grow relatively unfettered from regulation. At the same time, social protections have been forcibly weakened through undermining of job security and social security, along with the financialisation and privatisation of health, education, and elder care. Statistics show that wellbeing peaked before the introduction of neoliberal policies, and has been declining since the 1970s (Hamilton, 2003; Skidelsky & Skidelsky, 2013). The wellbeing promised by growth has therefore been replaced by a pale imitation, driven by consumerism and advertising. Indeed, this consumerism is driven largely by faith that it will bring about the utopia of a good life: 'the compulsion to participate in the consumer society is not prompted by material need or by political coercion: it is prompted by the belief of the great mass of ordinary people that to find happiness they must be richer, regardless of how wealthy they already are' (Hamilton, 2003, p. xvi).

Despite the regressive social policies that have prevailed under neoliberalism, the 'growth fetish' remains dominant in policy discourses. Institutional approaches that prioritise growth are touted as the touchstone of policy success (Hamilton, 2003), under the guise that they are necessary to alleviate societal issues from unemployment, to health and education spending. The myth promises that with more growth there just may be a reinstating of the social goods that were eroded in the neoliberal era. What is not pointed out is that when GDP was less, economies could offer more social protection! Despite the compounding of growth and worldwide GDP therefore, other debt burdens have eroded any potential for social progress. The financialisation of everyday life (Lapavistas, 2013) to meet the debt burdens of existing in contemporary capitalist economies, has resulted in a financial burden larger than in times of lesser GDP. Therefore, the link

between increasing GDP and the promise of a 'good life' are problematic.

Indeed, arguments are made that growth needs to be decoupled from indicators of wellbeing, and a more critical analysis of the norms around growth need to be articulated (Hamilton, 2003, p. 3). A positive correlation between growth and wellbeing is unfounded, with some countries with a lower GDP showing up higher on wellbeing scales than some with greater GDPs (Hamilton, 2003, p. 26). GDP is also a poor indicator of wealth distribution, masking inequalities, and other social factors that influence wellbeing. It does not account for indicators that lie outside what can be measured by the market. Thus, while the social progress of economies, for example under austerity practices in EU countries, is undoubtedly regressive, the return to positive GDP supposedly signals success. Indeed in the Greek case, a return to positive GDP did not signal the end of their recession, but merely indicated that prices were falling faster than nominal national income in a deflationary spiral. The incumbent Greek prime minister outlined this phenomenon in an open letter to Germany, published in *Handelsblatt* on January 13th 2015:

Respected commentators have been referring of recent to Greece's stabilization, even of signs of growth. Alas, 'Greek-recovery' is but a mirage which we must put to rest as soon as possible. The recent modest rise of real GDP, to the tune of 0.7%, signals not the end of recession (as has been proclaimed) but, rather, its continuation. Think about it: The same official sources report, for the same quarter, an inflation rate of -1.80%, i.e. deflation. Which means that the 0.7% rise in real GDP was due to a negative growth rate of nominal GDP! In other words, all that happened is that prices declined faster than nominal national income. Not exactly a cause for proclaiming the end of six years of recession (Tsipras, 2015)!

With respect to the environment and ecological concerns, GDP as a measure of ecological wellbeing fares little better. Under such measures, the decline and depletion of natural resources shows up as a positive economic activity. Thus, such measures do not account for the long-term costs associated with wasteful and unsustainable economic growth. Indeed, GDP can treat the irreversible depletion of a natural resource as an economic gain for that year, not accounting for even economic eventualities once the resource has been completely depleted. Yet, policies are built around protecting and encouraging the conditions for growth in GDP, often to the neglect of a more holistic perspective that incorporates the need to maintain and repair the ecological system.

For the domain of planning we therefore see a number of tensions in the form of 'fixes' that impair progressive strategies in favour of growth-based priorities. The dominant discourse is that growth needs to be maintained and encouraged. Yet, compounding growth is unsustainable as it ultimately leads to an inflexion point where the doubling of the economy every 30 or so years puts the ecosystem under successive waves of pressure to the point of ecological overshoot. This is most urgently manifesting in climate change due to atmospheric GHGs. However other planetary boundaries are increasingly breached by frenetic, compounding production for growth. Not only this but growth does not necessarily equate with societal wellbeing beyond a certain baseline. As a profoundly social species, notions of progress and collective wellbeing arguably form part of the societal 'imaginary' or indeed the Jungian 'collective unconscious' that greatly interconnects humans as a species. Yet, at a time when social safety nets and progressive social systems that lubricate and smooth societal functioning are eroded, the 'growth fetish' remains dominant to the extent that society must sacrifice progressive systems to prop up growth. However, this begs the question: why

growth if not for the enrichment of society? This difficult and challenging question is unenviably well within the remit of planning. As if this were not enough, a second perspective needs to be considered more thoroughly, that of 'fixes'. It is to this perspective we now turn.

5. Theoretical perspective 2—fixes

5.1. Spatial and temporal fixes

The concept of a 'fix' as a way of resolving economic crises is a long established one. Most recently, technological fixes have tended to grow and trend as a fix of choice of neoliberal ideology. This will be discussed later. However, the idea of a 'spatial fix' is familiar in geography domains from the work of David Harvey. Harvey's concept of the spatial fix 'is a general term that refers to many different forms of spatial reorganisation and geographical expansion that serve to manage, at least for some time, crisis-tendencies inherent in accumulation' (Castree & Gregory, 2006, p. 146). The implication is therefore that a fix acts not as a long-term solution but as a way of deferring, deflecting or 'fire-fighting' crisis tendencies so that they are no longer immediate and urgent, but resolved to a state of temporary equilibrium. The implication of the fix is therefore a suspension, or postponement for another future crisis. Indeed, the spatial fix only ultimately serves to intensify crisis tendencies in the long run, as the core causes of crisis are never resolved, merely moved around in space. The spatial fix is viewed as a necessary aspect to capitalist economies, in that the in-build tendencies towards crisis in capitalist economies are temporarily deferred by spatial expansion and transformation. However, as successive iterations of crisis unfold, the spatial fix, and indeed 'cascading spatial fixes' (Harvey, 2010, p. 50) bolsters the expansion of the geographical reach of the crisis-prone system, thereby spreading and intensifying the inherent crisis tendencies as it expands (Harvey, 2010, p. 149).

Related to the spatial fix is the temporal fix, whereby capital finds temporary solutions to crisis through finance and credit. The operation of finance and credit help to defer potential lack of return on investment of fixed capital, therefore providing dividends, stocks and future value guarantees before the maturity or viability of the capital investment is guaranteed. However, this has ultimately led to an entire 'shadow banking' sector of 'credit default swaps, currency derivatives, interest rate swaps' in which not only banks but other private corporations have extensively participated (Harvey, 2010, p. 24). Indeed, corporations that previously were engaged in production entered the financial markets, deriving more profits from that aspect of their business than the productive aspect (Harvey, 2010, p. 23). This 'fictitious capital' has allowed the temporary crisis tendencies of capitalism to be temporally deferred, as it was during the growth of neoliberalism from the 80s until the financial crisis of 2007, where tenuous faith in the fictitious asset values evaporated. Another aspect to the temporal fix is in how it can use everyday consumer credit to defer, or indeed mask the neoliberal trend of wage suppression. With these trends, wages were no longer rising in line with productivity, and therefore would have led to market stagnation, had the 'temporal fix' of consumer credit not been advanced. Thus, 'the gap between what labour was earning and what it could spend was covered by the rise of the credit card industry and increasing indebtedness' (Harvey, 2010, p. 17).

Therefore the overall tendency in the development of neoliberal capitalism has been in both spatial and temporal fixes, where finance predominates over industrial production, and temporal fixes predominate through the privatisation of long-standing 'commons' resources for short-term private profit. The temporal fix with respect to privatisation operates in such a way as to ensure

that capital benefits from public and state investments in infrastructure even though it did historically not have a hand in their development (Magdoff & Foster, 2011, p. 136; Harvey, 2010, p. 49). Thus, capital benefits from the prior temporal infrastructural investments of public and state entities, from prior 'commons' in the form of natural resources, and in the taking over of previously public funds in an 'expropriation of occupational or public pensions and other funded future welfare entitlements for immediate profit' (Castree & Gregory, 2006, p. 151).

The spatio-temporal fix is a concept that describes the dovetailing tendencies of capital to defer crises through both spatial and temporal means. Increasingly and progressively, the spatial fixes required for deferral of crisis are accompanied by the temporal fixes such as financialised supports and actions on labour power. Therefore, the spatio-temporal fix is 'a metaphor for solutions to capitalist crises through temporal deferment and geographical expansion' (Harvey, 2004, p. 65). These fixes can take several guises and combinations such as the geographical expansion of markets along with deregulation of labour laws, or expansion into new labour markets along with capital investment. Aligned with the concept of the spatio-temporal fix is the concept of 'structured coherence', whereby the affordances of the fixes create functional boundaries within which capital can continue to operate and reproduce itself. Such a 'structured coherence' afforded by the spatio-temporal fix 'displaces and defers contradictions both within a given economic space and/or political territory and beyond it. It also involves an internal as well as an external differentiation of winners and losers from a particular fix, linked to the uneven social and spatial distribution of benefits from a given fix and to its associated uneven development' (Castree & Gregory, 2006, p. 163). Whilst the concept of spatial and temporal fixes are key to the broad understanding of how capital can potentially defer crisis, this article is concerned with how its tendencies manifest when faced with ecological crisis. It contends that currently active 'fixes' are in the realms of technology and finance. We therefore first turn to the area of technological fixes.

5.2. Technological fixes

It is evident that the neoliberal era has fetishised 'free market' accumulation strategies in general. In particular however, the methods of accumulation include a transition to a 'knowledge' or 'smart' economy that glorifies innovation and entrepreneurship. Innovation is seen as a panacea to problems of stagnation, to the extent that despite crippling austerity programs across Europe, citizens are encouraged to act as entrepreneurs that can innovate their way out of crisis. Innovation is also seen as a solution to ecological crisis, not least in the extreme tech-fix of geoengineering, amongst other technological 'dreamware'. Technological innovation is, in particular, to herald a new era of prosperity, democracy and freedom in its incarnation as the 'information revolution', and in doing so erodes class differences, promotes equality and fairness. However, critiques of this position argue that this fetishisation of technology is merely an 'ideological smoke-screen' for a reorganisation and concentration of capital associated with the neoliberal era (Neubauer, 2011, p. 195). Indeed the dovetailing of 'informationalism' and neoliberalism since the 1970s have, it is argued, 'helped orchestrate and legitimate a reorganization of global hegemony organized around neoliberal regimes of flexible accumulation' (Neubauer, 2011, p. 196). In conjunction, these dovetailed processes, rather than enhancing citizenship 'undermine[s] the very possibility of meaningful democratic citizenship' (Neubauer, 2011).

The core ideology connected with this development of 'informationalism' is the notion of technological determinism. This perspective promotes the idea that agency lies primarily with

technologies; that the technologies are somehow autonomous and outside the influence of societal factors (Castells, 1999; McLuhan, 1964, 1967). Such approaches imply that technology operates at an overarching macro level, outside of societal and cultural domains, but not economic ones. This standpoint has proven to be problematic, in that by placing agency primarily with technologies, it ignores influences on the origins and uses of new technologies, including the military and political genesis of many information and communications technologies. Such a determinism can promote a form of 'hype' around new technologies, and thus can encourage a 'cultural air' (Preston, 2009, p. 12) that defers symbolic power to the technology itself.

Determinism also implies an uncritical inevitability about technological progress and change. The predominance of such determinism in, for example, political institutions, potentially marginalises or ignores critiques of technology and its role in society. Often, the theory of technological determinism 'is one that most frequently informs popular and journalistic accounts of the effects of impacts of new ICT' (Preston, 2001, p. 111). Lister, Dovey, Giddings, Grant, and Kelly (2003) observe how McLuhan's determinist theories appeal to big business, in that they serve corporations 'a source of propaganda' (Lister et al., 2009, p. 73), and how in a more general societal setting, it appeals to those who view new digital technologies 'as bringing about radical cultural change or have some special interest in celebrating its potential' (Lister et al., 2009, p. 73).

Williams (1974) and MacKenzie and Wajcman (1985) proposed a more nuanced relationship between technology and society. They posited, counter to the determinist position, that technology can be shaped by many different social factors, for example, cultural prejudice, science, existing technologies, context within a system, and path dependence. However, crucially, this stance is not foregrounded or given prominent attention in political agendas or in policymaking. Therefore, a dominant 'fix' for economic and indeed ecological issues becomes a 'technology fix'. Even the actor-network theory (ANT) approach, which suggests that technology and society are mutually constitutive, is not often acknowledged. A key tenet of ANT is that society is intrinsically networked, thus allowing for the standpoint that a technology can effect a societal network, but importantly that the technology is not outside the network and can itself be affected through being part of the hybrid network (Law, 1992; Lister, et al., 2009).

With the dominance of technological determinism and the 'technology fix', it is not surprising that attention is paid to such fixes in terms of resolving economic crises. Thus, technology becomes fetishised (Adorno, 1991) to the extent that 'the fetish belief then takes hold that there is either a technological or a spatio-temporal fix for every problem capital encounters' (Harvey, 2010, p. 158). Technology fixes presume that a new innovation or product will absorb surplus capital through the consumer market in mature economies, or that in developing countries, the outsourcing of production, its accordant technologies and intellectual property rights will absorb the surplus. The dovetailing of the technology fix and the spatio-temporal fix can be seen in the foregrounding of innovations that speed up the processes of capital. One account outlines the sheer pace and scale of the technology fix and its dovetailing with finance in the form of high-frequency trading, describing:

a market beyond human control, dominated by super-fast machines running complex computer algorithms that jostled and fought each other at the level of milliseconds, micro-seconds—and with no meaningful oversight. The familiar cliché of gaudily dressed men waving arms on a stock market floor was history: trading now happened within black boxes housed in highly secure, unmarked "data farms" (Smith, 2014).

Given the preponderance of technological determinism, 'informationalism' and the technology fix in public and political discourse, it is tempting to acquiesce to the consensus that technology provides the best fix for the various challenges of contemporary society. The fuelling of this belief by neoliberal ideology makes for a powerful mix, where capital fuels investment, speculation and venture financing of technology. Indeed, Tony Blair, a former New Labour prime minister of the UK has upon the defeat of Labour in the last UK election, championed technology as a key policy area for the reform and rebuilding of the Labour party. This is unsurprising, given Labour's turn to neoliberalism under Blair. Yet his most recent decree that 'technology alone should be revolutionising the way we deliver public services' underscores the extent to which the technology fix is seen as a panacea to societal and political ills (Blair, 2015).

However, the hubris of technology is, like the hubris of neoliberalism, unfounded. It is therefore key that the domain of planning adopts a nuanced and critical stance when confronted with a technology fix. Critical studies of technology reveal that technology is not always neutral, is not always the 'best' answer to a complex societal problem, and can have unintended consequences pertaining to its deployment, particularly when the interests of capital investment are to the fore (Winner, 1986). Indeed, when the 'fixing' of the planet through technological means is mooted, it is necessary for planners to adopt a deeply critical approach to the solutions proffered by default.

5.3. Technology and growth

In the current economic paradigm, technological innovation is seen as a necessary elixir, with the result that the fetishism for innovation is 'fed upon to the degree that innovation itself becomes a business that seeks to form its own market by persuading each and every one of us that we cannot survive without having the latest gadget and gismo at our command' (Harvey, 2010, p. 91). The naturalisation of growth also naturalises the perspective that assumes and promises that technology, the innovation of which enabled by growth, will find a solution to the economic and ecological crisis. Such a perspective fails to take into account the material demands of technological production. Thus, rather than a realistic prospect, the technology fix and imperative of innovation are, in terms of ecological crisis, utopian and aspirational. As Jackson observes 'assumptions that capitalism's propensity for efficiency will allow us to stabilize the climate and protect against resource scarcity are nothing short of delusional' (Jackson, 2009, p. 7).

Indeed, it is now well established that the marks that this 'century of the self' has left on nature are all but indelible. The very system that has used the 'free gifts' of nature for accumulation, at once treats nature as an externality. In its quest for growth, the spatial impact on the planet is clear, with vast swathes of the earth transformed and incorporated into the production system. In this way, production also transforms the earth upon which it acts – a process that policies focused on growth fail to connect with the ecological dimension. However, the 'production of nature' is increasingly an integral part of the economic process of capitalism. Production under capitalism externalises nature, and assumes nature to be 'other' or 'out there', to be dominated, controlled and manipulated for the requirements of capital, often under the guise of necessary technological innovations.

The extreme of this technology fix with respect to the ecological crisis is in geoengineering, where the use of emergent technologies to change the earth's climate system is preferable to using alternative economic paradigms to ensure the human economic system is not overshooting the planetary capacity to host it. The utopian promise of geoengineering 'seems irresistible – it is cheap,

effective and free of the unpalatable side-effects of carbon abatement, such as the wrath of fossil fuel corporations and the resentment of voters willing to make only symbolic changes to their ways' (Hamilton, 2013, 2003, 2014: preface). These technologies promise either the removal of carbon from the atmosphere into underground storage facilities, or solar radiation management to mirror radiation from the sun back into space. However, these technologies do not seek to solve the cause of the problem, nor even attempt to clean up the earth, rather 'an attempt to mask one of the effects of dumping waste into the sky, a warming globe' (Hamilton, 2003, p. 1). Some schemes suggest the removal of northern forests as they, being dark, absorb radiation whereas if they were removed, they may be replaced by ice which would bounce solar radiation back. Similarly, a mountain in Peru is to be painted white, with research funding from the World Bank, in order to encourage cooling and ice formation. Another masking is proposed on a grander scale whereby if the earth's orbit could be nudged just a little farther from the sun, the cooling required would happen naturally, albeit with the result of the year becoming 5.5 days longer (see Hamilton, 2013: 2–3 for accounts). This is achieved with a magical array of nuclear charges, asteroids and very precise calculations.

Through the lenses of these technology fixes, the earth is a moveable feast – literally – whilst the economy cannot be tampered with. As Hamilton observes, geoengineering represents 'the ultimate expression of humankind's technological arrogance', whilst 'climate engineering is intuitively appealing to a powerful strand of Western technological thinking and conservative politicking that sees no ethical or other obstacle to total domination of the planet' (Hamilton, 2013, p. 13). Thus, over-hubristic faith in technological solutions is not without its connections to power and capital. For planning for climate change therefore, it is critical that technological 'fixes' or short cuts are not foregrounded to the detriment or marginalisation of social, non-technical and non-market approaches.

5.4. Introducing the techno-finance fix

In the last thirty or so years, the economy has become increasingly financialised, from the financialisation of everyday life, to the manifest requirements of states and international actors to keep the system of finance running with massive bailouts of this private sector with public monies. This financialisation lubricates the cogs and wheels of global capital, allowing seamless and borderless transactions of vast sums between banks and corporations. The foreclosing of both spatial and temporal distance facilitated by networked communication has enabled financialisation to become increasingly dominant, shortening the timelines of monetary transactions. This serves capital in that the requirements of expansion also increasingly require the barriers to trade to be diluted or rescinded entirely. The neoliberal turn has further amplified this process of increased rates of financial turnover. This in turn fosters an economic landscape based on short-term horizons with respect to returns on investment, and therefore also amplifies the compounding of growth. This is the finance aspect of the techno-finance fix.

On the other hand, the financialisation of the economy has also fuelled a certain technological fetishism. Not dampened by the dot com crash of 1999–2000, capital speculates on technological innovations for future profit-making. Technology and innovation therefore go hand in hand in this system, with calls from media and policy circles to invest in innovation and entrepreneurship, especially when crisis hits and capital needs a jump-start back to growth. However, the spurious development of endless technologies merely persuades citizens to become active

consumers, through psychological obsolescence and shortened product life cycles (Slade, 2006).

These processes are manifest in policy circles, but particularly emergent in climate policy. Whilst the technology fix and financialisation have been separately problematised with respect to climate change, this article posits that there needs to be an acknowledgement of the dovetailing of these processes into a dominant process – thus introducing the term 'techno-finance fix'. This term refers to the way in which financialisation and market logic has become dominant, whilst a corresponding technological determinism has also become dominant. However, it is important to stress that the 'techno-finance fix' implies that these are not two separate processes. Rather they are in a symbiotic and sometimes dialectical relationship operating under the conditions of global capital. In their mutual enforcing of each other, these processes combine to a powerful narrative, the logic of which influences decision-making at political and policy levels. In short, when it comes to climate policy, the dominant discourses first acknowledge the problem of climate change, then set to the task of mitigating it by placing faith in technological fixes. This faith in technology is added to in turn by faith in the ability of financial instruments to both fund technological breakthroughs, and to act as arbiter for greenhouse gas reduction through futures trading in GHGs and other pollutants.

5.5. Summary

The salient theoretical issues for this article are concerned with tensions between economic and ecological imperatives. On the one hand, prevailing economic thought positions the maintenance, repair and development of the global capitalist economy as an imperative, otherwise this system, built on accumulation and surplus, runs into crisis. On the other hand, urgent action is required to both mitigate and adapt to climate change due to scientific consensus that 'business as usual' cannot continue with dramatic impacts on the entire ecosystem. However, this article posits that due to the dominance of neoliberal ideology, the range of options for climate adaptation and mitigation deemed viable will tend towards 'fixes'. We acknowledge the continuing importance of the concept of spatial, temporal and spatio-temporal fixes and introduce the more particular concept of the 'techno-finance fix'. The article thus posits that international, regional, national and local policies will tend to be tainted with the techno-finance fix, rather than tending towards moves that directly challenge the idea of business as usual. This is despite the same body of policy largely acknowledging that business as usual is not ecologically sustainable. Thus, we posit that the policy landscape is potentially fraught with tensions between the maintenance of the economic status quo, through the application of 'fixes', and the ecological constraints and limits that are increasingly being reached and breached. As the domain of planning is the domain that acts in a practical way on policy pronouncements, planning therefore stands at a key position, albeit unenviable, with the remit of balancing these tensions. This will be discussed, but first the policy landscape is selectively overviewed to assess to what extent the techno-finance fix is in evidence.

6. International policy and the 'techno-finance fix'

In this section, selected international policy documents are analysed for their perspectives on mitigating or adapting to the ecological crisis. The selection includes work from the UN, from which the IPCC draw their remit. The IPCC reports themselves are analysed for evidence of the techno-finance fix. In acknowledging the dominance of neoliberal capitalism previously, this article also

deems the OECD and the World Bank as key actors that can reinforce prevailing thought. They are therefore included for analysis, along with a report from the WWF, a non-governmental organisation that has significant international standing. The inclusion of these actors is timely in a global ecological context where 'the liberal environmental norm complex emerged during the 1970s out of struggles between the UN, the OECD and the World Bank over the nature of the connections between environmental protection and international economic development. Due in large part to the increasing influence of the OECD within the United Nations Environmental Programme, liberal environmentalism emerged as a compromise between environmental policy and emerging neoliberal orthodoxies' (Whitehead, 2013, p. 1356).

In order to unpack and problematise the overall project of liberal environmentalism therefore, the concept of the 'techno-finance fix' is developed in this article as a particular response to the ecological crisis, and it is applied as an analytical lens to policies from these significant actors. The techno-finance fix concept combines techno-optimism with a continued reliance on finance to ameliorate the ecological crisis, and implies that these processes are necessarily in tension with the requirements for true mitigation of climate change. This section focuses on salient aspects of the latest IPCC AR5 reports. Whilst not policy documents per se they form the basis for policy actors across global economies to act on climate change. It then reviews other selected international documents, including UN, OECD and World Bank offerings, to assess to what extent they follow the 'techno-finance fix' paradigm typical of liberal environmentalism, or whether this paradigm is critiqued in favour of alternate socioeconomic paradigms.

6.1. The IPCC

The Intergovernmental Panel on Climate Change produces reports on climate change from which policymakers and planners can draw climate-related actions on a regional, national and local basis. The United Nations Framework Convention on Climate Change (UN 1992) instituted the IPCC, requesting a panel for research, and also specifying the parameters of their research brief. The IPCC have to date released five assessment reports, the latest (AR5) published between 2013 and 2014. The brief of the IPCC is drawn from the UNFCCC document, which specifies that the ultimate aim of the convention is to stabilise greenhouse gas (GHG) emissions in order to prevent climate change. A noble aim – with some caveats however, in that 'such a level [of emissions reduction] should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner' (UNFCCC – emphasis added).

This is significant, in that from the top down, economic development is enshrined without question of the growth paradigm. As this article is concerned with any policy conflicts that can emerge at an international level to influence regional and national policy, it is of concern that right from the top is an economic caveat in the terms of climate change mitigation. The IPCC, working under these guidelines is thus charged with finding solutions that will similarly not rock the economic boat, despite the latest pronouncements that the 'business as usual' growth-based economic and social formations are not an option (IPCC, 2014b).

This sets the scene for the institutional context in which the IPCC operates. The IPCC consists of three major working groups (WGs). WGI is concerned with the physical science basis to climate change, WGII concerned with risk and adaptation, and WGIII

concerned with mitigation strategies. WGI is covered here in brief for some salient points that form the basis of many of the ensuing political and economic arguments. Being concerned with the scientific basis, it does not pronounce on economic or social formations and is thus not subject to critique here. With overwhelming agreement on the physical science basis, this article asserts that it would be unhelpful to debate the validity of the findings of WGI, lest any hint of climate denial is suggested. To be clear – this article asserts that the 'what' of anthropogenic climate change is not contested. Rather, it explores the political economy of 'how' climate change can be treated under conditions of growth-based economics that offer technological and financial fixes rather than exploring alternate socio-economic formations.

6.1.1. WGI

WGI in its latest report (AR5) has stressed that with better instrumentation and measuring, their confidence in assessing humankind's influence on the climate has never been more accurate. They have stressed that there is unequivocal warming in the climate system at an unprecedented level since the 1950s (IPCC, 2014b, p. 4), and that a primary driver of climate change is atmospheric carbon dioxide (IPCC, 2014b, p. 13). Thus, this group advises that continued emissions of carbon and other GHGs will lead to further warming, with 'substantial and sustained' reductions of emissions the only option to mitigate climate change (IPCC, 2014b, p. 19). Along with the main message of human impact on the climate system, WGI offers a new series of models, termed RCPs (representative concentration pathways) that simulate temperature changes according to the level of carbon in the atmosphere. The RCPs model concentrations from RCP 2.6, which is the one most likely to keep warming under 2°, up to RCP 8.5, which will set the planet on target for 6° warming as early as 2100. Thus, a salient point from WGI is that there is a choice of climate outcomes depending on the extent of decarbonisation that is achieved over the next decades (see graph on IPCC, 2014b, p. 22 for a graphical comparison of temperature, precipitation, sea ice extent and ocean acidity under RCP 2.6 versus RCP 8.5). In summary, WGI stresses that climate change is unequivocal, is caused by humankind in the form of GHG emissions, and that there are pathways to either keeping warming under 2° or up to 6° and even beyond, depending on how much carbon emissions reduction is achieved in the coming decades.

6.1.2. WGII

WGII draws on the data from WGI and interprets it to assess the risk to societies and how they can build in resilience in their adaptation to climate change. A salient point is that climate change is already happening and is affecting societies – highlighting the fact that the climate has already warmed approximately 0.7° on pre-industrial levels. Thus, WGII observes that contemporary society is about a third of the way towards 2° warming (IPCC, 2014a). The concerns of WGII include how the global south is more vulnerable to climate change from underdevelopment, yet these regions historically have not contributed to the problem (IPCC, 2014a, 2014b). For the purposes of our analysis, this is positive in that there is a discussion about wealth distribution, however watery, that admits that these issues are 'incompletely' considered in the research (IPCC, 2014a, p. 11). WGII also helpfully calls for an exploration of 'a wide range of socioeconomic futures in assessments of risks' (IPCC, 2014a, p. 11), which is challenging to the there is no alternative mantra of neoliberal capital.

However, such futures are left undefined, with WGII steering away from suggesting that futures may involve degrowth of some areas. Rather, it underpins the importance of 'international dimensions such as trade and relations among states' (IPCC, 2014a, p. 11). Undoubtedly these relations are important, but it is

important to consider them under the dominant paradigm of global neoliberal capital, not least for the economic inequality, resource stripping and transport emissions that such relations foster. However, the lack of critique in the discussion potentially leaves the door open to interpretations that suggest that an intensification of global connectedness is required to incorporate these regions into the system of global capital. Having identified the propensity for capital to require fixes, the idea of intensifying trade at a time of ecological crisis is firmly in the realm of a 'fix' that can keep the global growth economy alive, whilst performing a semblance of action on climate change.

Notwithstanding this, WGII do discuss the impacts of climate change on key economic sectors and services. The key message is that most economic sectors will be adversely affected by climate change (IPCC, 2014a, p. 19). However, the exact impacts are deemed difficult to predict, especially if there are sudden or catastrophic events or tipping points (IPCC, 2014a, p. 19). Indeed, according to the evidence, it is especially difficult to predict with warming above 3° as 'losses accelerate with greater warming' (IPCC, 2014a, p. 19). This sends a message to even the most ardent adherents to cumulative growth that economic 'business as usual' is threatened as impacts of climate change intensify. If for no other reason than to protect economic development, the message of WGII is clear that immediate mitigation and adaptation strategies are required. If not opening the discourse to alternative or new socioeconomic paradigms, the discussion at its most conservative still requires immediate and sustained action within the current paradigm. Of course, if the economy is not fundamentally changed, any actions for the purpose of maintenance of growth-based paradigms are bound to be firmly in the realm of 'fixes'.

The report also notes that with climate change set to affect economic growth, poverty reduction may be more difficult in the future. The suggestions in the report are peppered with neoliberal ideology, asserting a positive role for the more neoliberal and financialised economy in public-private partnerships, loans and risk-financing, with government regulation and oversight only playing a role as 'insurers of last resort' (IPCC, 2014a, p. 26). This is problematic in terms of a 'disaster capitalism' type of fix, whereby futures instruments potentially stand to benefit from the natural disaster, using it as an opportunity to strip away previously existing economic and social structures in the region, and replacing them with neoliberal models of social precarity and consumerist economics (Klein, 2007).

However, the report does offer a mild critique of this in the form of a caveat whereby 'without attention to major design challenges, they can also provide disincentives, cause market failure, and decrease equity' (IPCC, 2014a, p. 26). Likewise, what WGII suggests as being important 'transformations in economic, social, technological, and political decisions' to encourage 'climate-resilient pathways' are not clearly articulated (IPCC, 2014a, p. 28). This leaves potential for exploration of transformations in areas beyond the techno-finance fix, given that the choices available are not yet foreclosed. However, whilst aspirational to hope for transformations in social, economic and political areas, the document steers away from outlining what the transformations potentially entail. Arguably, the trajectory could move towards the intensification of neoliberal policies, thus increasing further the use of GHGs to support transport of 'free trade' goods in an intensifying consumerist economy without any regulatory oversight.

In short therefore, WGII has given its assessment that climate change is already presenting itself, that it will continue, and as it does it will be particularly difficult for those in the global South to cope. It strongly and admirably advocates the urgent need for solutions beyond the techno-finance fix to these issues for those societies in particular. However, the document is potentially read as germane to 'disaster capitalism', where as natural disasters and

extreme weather events take hold, neoliberal capital can provide finance-based fixes whilst asset-stripping and commodifying the afflicted areas (Klein, 2007). The report also couches the costs and challenges of climate change in economic terms, with damage and loss to equity featuring in their warnings. Whilst it is important not to be over-idealistic about this, the very stability of the planetary ecosystem is of such great and global importance that it is hubristic to assume that the very flawed, crisis-prone and unstable market is the best tool alone for this tremendous task. The fluctuations of the market are also to the fore in the warnings from the working group that poverty alleviation may be compromised depending on market conditions.

In summary therefore, WGII leans towards the notion that finance can strongly influence adaptation and mitigation strategies. Finance is in the realm of the temporal fix, and therefore an instrument for mere deferral of crisis. While WGII mention the use of technology to assist with climate adaptation and mitigation strategies, it also discusses non-technology changes in social, economic and political dimensions. Therefore, WGII can be seen to exhibit tendencies towards techno-finance fixes, with a priority on the finance aspect to such fixes.

6.1.3. WGIII

The next area to analyse is WGIII and its remit to function as a 'map-maker' to provide policymakers with an overview of mitigation strategies without being prescriptive (IPCC, 2014b). Whilst laudable in theory, a critical reading of this document assumes an unchanging economic paradigm, therefore implying that a 'business as usual' approach can be taken to mitigation. The document is concerned with the costs of mitigation, thus couching the costs largely in economic terms. It takes greenhouse gas (GHG) reduction as core to mitigating the effects of climate change without taking the wider perspectives from WGII as to the effects of many aspects of the economic system on the planet – ocean acidification, deforestation, land use, uneven development and inequality. In discussing the costs of mitigation, WGIII also assumes that the economic system has to stay and growth has to be maintained. Therefore, their discussion of consumption reduction stands at odds with the logic of maintaining the economic system based on producing surplus. Importantly, the aforementioned Article 2 of the UNFCCC is directly quoted as forming part of their framework (IPCC, 2014b, p. 4). This tacitly enshrines the requirement for economic development. However, the WGIII is aspirational in its approaches to mitigation, if not in practice, in that they acknowledge that exceptionalism and self-interest of states is counter-productive, and that issues of equality, justice and ethics are part of mitigation (IPCC, 2014b, p. 5–6).

This working group is concerned with the interplay of economic factors with GHG emissions. However, it fails to adequately critique them. For example, it is this group that indicates that not only have GHG emissions increased since 1970, but that the *rate* of increase has itself intensified, slowed only briefly by the economic crisis in 2007–8. The group makes the startling observation that 'despite a growing number of climate change mitigation policies, annual GHG emissions grew on average by [. . .] (2.2%) per year from 2000 to 2010 compared to [. . .] (1.3%) per year from 1970 to 2000 (IPCC, 2014b, p. 6). The report also observes that "about half of cumulative anthropogenic CO₂ emissions between 1750 and 2010 have occurred in the last 40 years" (IPCC, 2014b, p. 7). Thus, WGIII acknowledges that the rate of emissions has been increasing despite increased amounts of policies targeted at limiting emissions (IPCC, 2014b, p. 84). This connection is important in that it underpins that despite efficiency measures in resource use, mitigation strategies, caps and trades, there is an overall upward trend. However the analysis does not go as far as to critique the underlying active mechanism in this process, which is a world

economy built on compounding growth. If this compounding growth problem were at least articulated, it may provide a partial explanation of the rate of increase in emissions despite the increase in mitigation policies.

With the emissions rate increase problematised by WGIII clearly at odds with the requirements for decarbonisation, this WG observes that a low-carbon future is characterised by a rapid transition to a 'full portfolio' of mitigation technologies and low-carbon fuel sources including nuclear and carbon capture/storage (IPCC, 2014b, p. 17). The technology aspect of the techno-finance fix is therefore foregrounded, with much given to the yet largely untested BeCCS (bioenergy with carbon capture and storage), along with similarly aspirational CDR (carbon dioxide removal) technologies. However, these technologies have no operational safety record, with the WG having to admit that such CDR strategies are 'to varying degrees, associated with challenges and risks' (IPCC, 2014b, p. 13). Thus, the technology fix, whilst aspirational, is also hubristic in that despite risks, they can be made operationally safe and viable.

Irrespective of this hubris around untested technology fixes, the WG stresses that delaying mitigation will make transition to a low-carbon economy more difficult, thus stressing the need for some mitigation strategy to be urgently implemented. The economic costs of this are well-articulated, with the WG observing that the costs associated with mitigation are difficult to quantify. An issue with the assessment of this WG and the technology fix lies in how they see CCS (carbon capture and storage) as potentially offsetting the negative effect on values of fossil fuels. This opens up the potential to be read as a green light for the fossil fuel industry, in that 'the availability of CCS would reduce the adverse effect of mitigation on the value of fossil fuel assets' (IPCC, 2014b, p. 18). Arguably this could justify continued emissions as some day in the future, the currently untested CCS strategy will solve the problem. This is an operational example of the dovetailing of the aforementioned technology fix with the finance fix, whereby the implication of financing the technology of CCS will allow capital accumulation to continue. This singular example reveals that the techno-finance fix is prevalent in this instance, along with a dangerous temporal fix that is awaiting the availability of the techno-finance fix and assuming it will defer crisis when it presents itself. Indeed, the report is confident that the techno-finance fix is a happy marriage, in that 'within appropriate enabling environments, the private sector, along with the public sector, can play an important role in financing mitigation', whilst 'technology policy complements other mitigation policies' (IPCC, 2014b, p. 29).

The report of WGIII can thus be critiqued for offering a choice of energy mixes that require untested, emergent technologies, and/or a nuclear option, which has not proven itself safe for even one generation, let alone the countless ones required to preside over its waste products. Indeed, if the inability to find solutions for carbon waste has consequences for the future, the inability to deal with nuclear waste is a measurably larger spectre for generations to come. Thus, the technology fix is problematic, particularly if the responsibility for waste management is in the hands of profit-making companies that are subject to the vicissitudes of the market. Moreover, with energy disruption from extreme weather more likely as the climate changes, the safety of certain technology fixes is profoundly contested. The Fukushima nuclear disaster is testament to the adverse intertwining of market and weather-related failures. Secondly, the finance fix that prioritises the market as the best means to provide the best solutions is also evident in the document. This is evidently problematic, in that the most economically competitive energy is currently coal, indeed undergoing a 'renaissance' as we have seen. Thus, market forces dictated the 'best' energy for fuelling power plants in recent years, leading to a rate increase in emissions, despite increased regulation and

mitigation policies. It is therefore at best naive to assume that a market fix will turn to support the cleanest or most efficient technology in the future.

6.1.4. Summary

It is apparent that the techno-finance fix is to a degree evident in IPCC reports, particularly WGIII. This is of concern in that it is informed by, and tacitly assumes, the continuation of existing economic structural arrangements. Whilst the reports acknowledge increasing geopolitical tensions, adverse socio-economic implications, and difficulties in maintaining growth under increasing conditions of climate stress, there is an underlying assumption that financialised markets will continue, and that these will support technological innovation. This naturalisation of economic processes by default will tend to foreground market solutions to climate change and economic crisis, despite the requirements of the market to produce compounding levels surplus for its operation. This arguably is then to the detriment of discourses that prioritise the non-commercialisation of natural and ecological processes, that foreground the sharing economy, or even highlight the regulation and management of markets.

Implications for planning therefore are clear, with a conflicting message that radical change is required, yet the only suitable mechanisms are in the techno-finance fix. Thus, the planning domain is potentially hamstrung away from exploring broad socio-economic paradigms, in favour of a transition to a merely different form of capital accumulation. This is particularly the case should the domain of planning only see climate adaptation and mitigation strategies in terms of the techno-finance fix. Arguably the challenge for planning is to seek more rounded solutions beyond the general spatial and temporal fixes, and the specific techno-finance fix. The IPCC reports contain much useful material and are to be considered as weighty works to be taken seriously. The reports reflect the prevailing bodies of knowledge around climate change, and thus reflect the dominance of a paradigm which can only consider 'fixes'. The IPCC are not the only international actors that can influence policy on climate change or ecological crisis. Other key institutional actors have also produced documentation on climate change, no less than the World Bank's Turn Down the Heat documents. It is to these documents that we now turn, to likewise assess the prevalence of 'fixes'.

6.2. Other key international policies

6.2.1. World bank

The World Bank has published three key documents, titled Turn Down the Heat. The first document, Why a 4°C Warmer World Must Be Avoided (World Bank, 2012), attempts to describe a 4° warmer world, drawing on data from IPCC AR4. This reads like an apocalyptic prophecy on current climate projections, should mitigation not sufficiently take place. However, the World Bank as a champion of neoliberalism is manifestly unable to critique the core aspect of the problem, which is that continued growth has always been coupled with increasing energy intensity and emissions (IPCC, 2014a, 2014b). This document therefore can be seen to represent an institution that champions the urgent need for action on climate change, yet cannot reflect on and critique its own core role in neoliberal and free market practices that have unfettered economic growth from any moorings in meaningful environmental stewardship.

However, the document acknowledges myriad unprecedented challenges, with both regional and global effects. The report acknowledges the difficulty in assessing the full scale of challenges but admits that 'although no quantification of the full scale of human damage is yet possible, the picture that emerges challenges an often-implicit assumption that climate change will not

significantly undermine economic growth' (World Bank, 2012, p. 64). The acknowledgment of the elephant in the room does little to add to hope for a paradigmatic shift in overall World Bank policies however. Thus, the World Bank is at a loss as to how their preferred type of economic growth can continue.

Their second Turn Down the Heat report, concerned with Climate Extremes, Regional Impacts, and the Case for Resilience (World Bank, 2013) describes their earlier document as a 'wake-up call' (World Bank, 2013, p. xi). This document focuses on the tropics and Sub-Saharan Africa, South East Asia and South Asia to assess climate impacts. It acknowledges the need to consider economic development through a 'climate lens' (World Bank, 2013, p. xii). However, the subtext throughout the document is that economic development must not be threatened by climate change. Thus, the areas identified as vulnerable are of concern as they are also sites for the expansion of capital. Under this assumption, climate strategies are important not for the wellbeing of the citizens of these regions, but for the protection and expansion of growth. The usual temporal and spatial fixes are in evidence, from 'smart agriculture practices' and 'promoting economic growth and the eradication of poverty and inequality' (World Bank, 2013, p. xv). Of course economic growth may be necessary to get impoverished regions up to decent living standards. However, the eradication of inequality is not, and has not been compromised through climate change alone, but rather through the social formation of the economy which in recent decades has been fuelled by neoliberal policies, of which the World Bank is a champion. Thus, the World Bank documents advocate the techno-finance fix amongst associated spatial and temporal fixes, they assume that 'smart' techno-practices and the market will supply answers to climate change, whilst maintaining and extending the prevailing economic paradigm.

Likewise, their latest offering, Confronting the New Climate Normal (World Bank, 2014) extends and complements the second document, utilising data from AR5 of the IPCC. This new analysis further underscores what was outlined in the prior documents in terms of risks and stark findings. However, their outlook is naively optimistic that the current economic system can remain and indeed thrive:

More and more voices are arguing that it is possible to grow greener without necessarily growing slower. Today, we know that action is urgently needed on climate change, but it does not have to come at the expense of economic growth. We need smart policy choices that stimulate a shift to clean public transport and energy efficiency in factories, buildings and appliances can achieve both growth and climate benefits (World Bank, 2013, p. xiv)

A key factor in supporting climate strategy is finance, vowing to 'innovate and bring forward new financial instruments' (World Bank, 2013, p. xiv) whilst innovating and using their powers of persuasion to tackle climate change. Whilst laudable, this document critiques the hubris of the 'techno-finance fix', its association with the neoliberal turn, and its dovetailing with liberal environmentalism.

6.2.1.1. Summary. The World Bank is a champion of neoliberalism with an interest in policies and practices for mitigating climate change. Whilst it is positive that such an institution acknowledges the uncertainties and dangers of inaction on climate change, their offerings can clearly be seen as firmly embedded in fixes. The techno-finance fix is in evidence to a certain extent, with a naive and tentative optimism that technologies and the market provide the best means to assist the most vulnerable to adapt to climate change. However, very little on inequality or wealth distribution is tackled in a meaningful way, and the growth paradigm is accepted

unproblematically. Thus when viewed through our theoretical lens, the World Bank reports largely encourage an intensification of business as usual.

6.2.2. WWF living planet

Another key document for analysis was the WWF Living Planet report, which extends the analytical landscape from climate change to a broader ecological domain. It observes that 'ecosystems sustain societies that create economies', thus acknowledging that the economy is a social process embedded in ecology (WWF International, 2014, p. 8). However, it also discusses the concept of 'natural capital', conceding that though this is an inadequate economic metaphor, it is necessary in that it 'encapsulates the idea that our economic prosperity and our well-being are reliant upon the resources provided by a healthy planet' (WWF International, 2014, p. 4). Thus, this document concedes to the economic thinking required by any advocacy group to hold legitimacy in evaluating the planetary ecological crisis. This reveals an awareness that contemporary ecological debate is centred on quantifying natural goods and processes into a form of 'capital', however reductionist this is.

A salient point from this report, apart from the massive reduction in biodiversity (a decline of 52% in their 'Global Living Planet Index' from 1970 – 2010), is how planetary overshoot is also intensifying. This is linked to living standards, further enforcing that the developed world has a greater ecological 'footprint' than underdeveloped regions. The document observes that a major challenge is 'for countries to increase their human development while keeping their Footprint down to globally sustainable levels' (WWF International, 2014, p. 12). However, further into the report there is a graphical demonstration of the existence of a correlation between development and unsustainability. Whilst the EU fares a lot better than US, the analysis reveals that 'no country meets both of these criteria' of having a good standard of living whilst not exceeding the biocapacity of the planet (WWF International, 2014, p. 60). The report also critiques the practices of developed countries, both in their use of resources, which is approximately five times that of low-income countries (WWF International, 2014, p. 59) and also their reliance on 'the biocapacity of other nations or the global commons to meet their consumption demands' (WWF International, 2014, p. 59). This is a positive acknowledgement of the challenges of decoupling a consumerist economy from ecological sustainability and whilst not an outright critique of the system, is at least critical of the promises of ecological modernisation. The document introduces the 'Oxfam doughnut' graphic, which articulates safe operating limits for planetary boundaries, whilst also including safe social boundaries of development. This is a means to critique the economic system, arguing that 'the doughnut illuminates the need for a new economic model that is both sustainable and inclusive – one which does not breach global planetary boundaries and which at the same time raises its citizens above a social floor' (WWF International, 2014, p. 68). For the authors, this goal can not happen under current growth paradigms and requires a radical shift in economic practices:

'this requires bold and transformational change in the purpose and nature of the world's economy. Rather than pursuing economic growth without regard for its quality or distribution, the Oxfam Doughnut shows how humanity needs an economy that redistributes power, wealth and resources to the poorest and focuses growth where it is most needed' (WWF International, 2014, p. 68).

Thus, this report foregrounds that any alternative economic paradigm must operate within the designated safe living spaces inside the doughnut, thus avoiding planetary overshoot whilst

ensuring an acceptable standard of living for all societies (WWF International, 2014, p. 68). In the assessment provided, the further decline of biodiversity is not a foregone conclusion (WWF International, 2014, p. 132) but articulates that there exist choices at government and policy level. The report is thus critical of policies 'with a myopic focus on economic growth and narrow interests', and business models 'that focus on short-term profits and fail to account for externalities and long-term costs' (WWF International, 2014, p. 132). It also critiques consumption for the sake of consumption 'that makes few happier or healthier' (WWF International, 2014, p. 132). This is progressive, in that it acknowledges the disconnect between GDP and wellbeing (Hamilton, 2003), and avoids the position that more economic growth is required to provide better social and ecological living spaces.

The document proposes some helpful strategies for changing policy so that the finite resources of the earth are 'embedded in every economic forecast and development strategy, in business plans and investment decisions, in our livelihoods and lifestyle choices' (WWF International, 2014, p. 100). Thus, best practice can be seen as that which does not 'silo' environmental policy, but sees it as integral to fiscal and social policy. The document also proposes two essential enabling conditions, the first of which is to redirect financial flows towards conservation and sustainability, and the second of which is to share resources (WWF International, 2014, p. 100). Whilst to a degree focusing on a financial fix in the short term, this is nonetheless progressive as it acknowledges financialisation but uses it in the short term to redistribute finance into areas needing urgent investment. This is contrary to the neoliberal model which would see the privatisation, not redistribution of resources in a more equitable way. It is therefore a challenge to the prevailing economic thought whilst also challenging the techno-finance fix in the longer term by its acknowledgement that more rounded strategies are required.

6.2.2.1. Summary. The WWF Living Planet report acknowledges the need to problematise ecosystem crisis in terms of 'capital', despite the inadequacy of concepts of equivalence or surplus in ecological matters. It expands the discourse from one of just climate change, to suggest the overall impact of economic activity affects many aspects of the ecosystem. It is therefore a move towards extending the discourse beyond the techno-finance fix, into more comprehensive offerings that also include political and social policies.

6.2.3. OECD

The OECD document *Towards Green Growth* (OECD, 2011) is a salient example on how ecological crisis is framed in a neoliberal framework. The core message of this piece is how beneficial growth has been and how a continuation of growth is required to maintain the benefits already accrued. The techno-fix is evident throughout the piece, although there are no specifics discussed with respect to ecological technologies. Thus innovation and technology are fetishised as panaceae without any specific analysis on how this comes about. For example, the document declares at the outset that 'innovation will play a key role' in green growth (OECD, 2011, p. 10). In contrast to the critique of development and ecological footprint in the WWF report, this is absent here, the report declaring that 'the ability of reproducible capital to substitute for (depleted) natural capital is limited in the absence of innovation. By pushing the frontier outward, innovation can help to decouple growth from natural capital depletion' (OECD, 2011, p. 10). This is despite overwhelming evidence that to date, there has been no decoupling of increased living standards and ecological overshoot. Indeed, it is the opposite, especially where the document provides a case study on 'Fostering a green

revolution – the experience from ICT' (OECD, 2011, p. 55). This eulogies the benefits of the ICT revolution in terms of its green benefits without, of course, mentioning the materiality of this industry and the exports of its pollution to the Global South (See Maxwell & Miller, 2012 for a critique).

The salient message from this report however, is that the market fix is to be encouraged. The document promisingly acknowledges that GDP does not account for natural capital in its measurements (Maxwell & Miller, 2012, p. 10). However, a critical reading reveals that the problem is the lack of incorporation of natural resources into an economic logic, as the environment is not commodified and commercialised enough to date. Thus, more enclosure is required:

'Barriers to trade and investment can place a serious break on the development and diffusion of green technologies globally. Reducing these barriers while providing effective protection and enforcement of intellectual property rights (IPRs) are essential to encourage the development and diffusion of technologies and the facilitation of foreign direct investment and licensing' (Maxwell & Miller, 2012, p. 12).

Therefore, the resource has to be enclosed and made a commodity for it to have any value. Indeed, IPRs feature heavily in this document as solutions, and the document warns that:

'incomplete property rights are in many cases a market failure but they are listed as a government failure to reflect the inefficacy or absence of policy to address these well-known failures in cases such as over-fishing. Similarly, the presence of regulatory uncertainty is a major impediment to private actions to reduce greenhouse gas emissions even though excessive greenhouse gas emissions are essentially a result of market failure' (Maxwell & Miller, 2012, p. 127).

When viewed as a mechanism through which financialisation operates, the extension of intellectual property rights in order to foreground technologies is one way in which this OECD document advocates the techno-finance fix. The fetishising of technology and innovation is evident throughout the piece with little regard to evidence on the ecological impacts or benefits of new technologies, especially ICTs.

6.2.3.1. Summary. Of any of the international documents analysed, the OECD one is most infused with the techno-finance fix. The intense dovetailing that is inherent in the concept of the techno-finance fix is evident in how the OECD sees an extension of intellectual property rights, financialisation and technology as key to mitigating climate change. This is firmly set within a growth paradigm also, where the key driver of policies is uncritically accepted as the need to maintain and increase growth. This is counter to the critique offered in this article that asserts assumptions around continued compounding growth need to be questioned and challenged.

6.3. Review: key points for planning

This section has drawn from a selection of policy and related documents at the international level to assess the degree to which fixes, and particularly the techno-finance fix are in operation. It reveals that from the UNFCCC there is a stipulation that ecosystem stability must not come at the cost of growth and development, thus enshrining the 'business as usual' paradigm. The IPCC has been revealed to be also hamstrung by this stipulation, with the excellent work of this organisation largely uncertain about socio-economic futures in the context of climate change. The analysis has revealed that whilst the IPCC strongly critique 'business as usual', the solutions it proffers fall to a significant extent in the remit of

solutions that require a dovetailing of market and technological fixes – the techno-finance fix. This has important implications for planning, as there is a profound agreement that climate change has already had effects, particularly amongst the most vulnerable citizens of the world. It acknowledges that a range of socio-economic futures need to be explored. However, to date, solutions are still hamstrung by the requirement to keep business as usual running, and to lessen impacts using market and technology fixes. This places the domain of planning in a central role to assessing, configuring and delivering plans for a range of futures that allows for market instability, changing economic paradigms, social insecurity and change, and generally can move beyond the techno-finance fix.

The policy documents from the World Bank and OECD are similarly concerned about the socio-economic effects of climate change. Yet they too are working under assumptions that the current economic system will be stressed, but will need to be stabilised. Evidence from these documents points in part to a hubris and faith in not-yet-existing technologies, with a commensurate belief that the market will deliver the conditions favourable to the development of this technological dreamware that is to rescue society from the spectre of climate change. Again, this is a key point for planning, and signals that the domain could benefit from an investigation into a range of social, economic and political interventions in order to move beyond the notion that the market and technology are the sole key ingredients to lessening the effects of climate change.

This concludes the analysis of international documents of interest. From the brief survey of selected works, the techno-finance fix, amongst other fixes, can be seen to be the default areas that policy actors turn to in order to proffer mitigation and adaptation strategies. This article is however, also concerned with regional actors, and thus turns to the EU to analyse how it assesses the international documents, and to what extent the techno-finance fix is in evidence.

7. EU policy

At the EU level, a selected number of policy documents are of interest for their attempts to challenge consumption norms, to take account of ideas of wellbeing, and to offer concrete policies for carbon mitigation.

7.1. Policies to encourage sustainable consumption

The first document to be analysed is a technical report from 2012 titled *Policies to Encourage Sustainable Consumption* (European Commission/Bio Intelligence Service, 2012). The policy brief for this report is helpful in outlining the tensions between public information on consumption and the role of the market. This document argues that there exists a failure at policy level to take account of 'the need for strong engagement of citizens on values, leading to an effective and long-term behavioural change' (European Commission/Bio Intelligence Service, 2012, p. 1). This is despite the usual policy instruments of 'regulatory, economic and informational' instruments (European Commission/Bio Intelligence Service, 2012, p. 1), and also despite discussion of approaches to behaviour change. The document observes how consumption can be influenced by limiting or constraining factors, as opposed to the assumption that consumption exists to meet desires (European Commission/Bio Intelligence Service, 2012, p. 1). Such limiting factors potentially involve the limiting of commuting by offering work from home practices (European Commission/Bio Intelligence Service, 2012, p. 3). Whilst a constraint on commuting, it is a positive for the employee who does not have to incur the time and cost of the daily commute,

whilst lessening emissions from transport. Thus, according to this report, sustainable behaviour change approaches need not be restricting or necessarily negative. Also, the document acknowledges that there can be an appeal to ethics and values and need not be the neoclassical assumptions around the rational actor (European Commission/Bio Intelligence Service, 2012, p. 1). Citizen actions can be encouraged at a policy level by appealing to the higher aspect of public sense. This challenges the 'free market' assumptions that rational actors enter the marketplace to satisfy their desires, with no concern for moral or ethical dimensions to trade. It also posits that markets can be regulated towards a higher ideal than desire-satisfaction, appealing to citizenship, commonality and the social good.

A workshop and case studies were held in order to accrue data for this report. Some key findings were that an integrated approach to behaviour change necessitated the inclusion of professionals, the public and public authorities (European Commission/Bio Intelligence Service, 2012, p. 1), in an integrated policy approach. However, this document also observes the tensions between needing to change behaviour and how far can policy go to change that. It discusses the role of marketing and advertising (European Commission/Bio Intelligence Service, 2012, p. 3) in terms of its shaping of perceived consumer needs. Thus, the document argues, the choice for policy with respect to behaviour change around consumption is to shift desires, or shift prices in order to make the goods unattractive. Whilst the former could involve a curbing of advertising, the document shies away from critiquing the freedom of the market, and indeed, tacitly assumes that the market cannot be interfered with:

The behavioural approach may lead policy makers into competition with commercial marketing. Most actions targeting consumers therefore require careful adaptation, which can vary according to country or even by region. This is an obstacle to centralized European action on consumer behaviour. Moreover, the social incentives for sustainable consumption often develop at the local level or by the action of communities of citizens (European Commission/Bio Intelligence Service, 2012, p. 3).

Thus, the implication is that a co-ordinated response to behaviour change is all but impossible because policy can not interfere with market functioning, even if this market is to provide an array of goods in the guise of 'choice' with little or no differences between offerings. However, it does move beyond the techno-finance to what can be done commercially, suggesting that consumption outlets such as shopping centres be subject to requiring that other services and cultural activities are also included (European Commission/Bio Intelligence Service, 2012, p. 4). However, if the market cannot be interfered with respect to advertising and marketing, it is likely that this move also would be regarded as unnecessary interference in the market.

7.1.1. Summary

This document whilst positively adding to the policy mix on sustainability is in itself hamstrung by market logic, where policies for sustainable consumption are met with opposition in the form of interference in the market. Arguably the market needs to be interfered with, especially given that it is market forces that have brought about the 'renaissance of coal' discussed earlier. Indeed, as austerity practices in the EU have also indicated, the neoliberal market is interfered with by the government, but only to distribute wealth upwards and to socialise private debt. Thus, it is possible to intervene in market affairs. The question is for whom and by whom is the intervention done. A more enlightened approach would thus acknowledge that if it can be done for the financial sector, it can be done for the ecosystem.

7.2. Living well within the limits of our planet

The next document for analysis is the 7th Environmental Action Plan titled *Living Well Within the Limits of Our Planet* (European Commission, 2013). This plan runs from 2013 to 2020 and takes a broad approach where living well includes protecting biodiversity and ecosystems, and the encouraging of moves towards the so-called 'circular economy' (European Commission, 2013, p. 1). There are nine major objectives, with the document admitting that despite legal frameworks including those for water, air quality and habitat directives, there still exists significant pressure on the ecosystem (European Commission, 2013, p. 2). A critical perspective here suggests that the reason for this is that the fundamental premise of compounding growth is not considered. This is similar to the critique of the IPCC reports which revealed that despite more legislation and regulation, the rate of carbon emissions has increased in the last fifteen years. Nonetheless, the document discusses policy objectives, including proper implementation of existing policy, and a techno-finance fix in the form of investment in innovation from both public and private sources. It acknowledges that the ecological costs are accounted for in such investments, and to implement this, the 'polluter pays principle' is to be instigated, along with the phasing out of subsidies for pollutants and a shift from tax on labour to tax on pollution (European Commission, 2013, p. 3). The difficulty not accounted for here is on the eventuality of the policy being a victim of its own success. In such an eventuality, where will the tax come from then to foster further innovation? Notwithstanding this, another policy objective involves integrating environmental policy into other areas such as agriculture, transport and energy. Significantly, it does not mention economic or fiscal policy. However, the suggestion is positive in that it echoes other calls seen earlier for a more integrated environmental policy approach.

7.2.1. Summary

This document to an extent falls prey to the techno-finance fix. However, it acknowledges that a holistic policy landscape is required for the task of enabling conditions of 'living well'. This is a positive intervention in terms of planning and policy, in that it goes beyond the traditional siloing of policy and acknowledges the need for integration in policy.

7.3. Signals

The 2014 EEA Signals document starts on a similarly integrated approach, stressing that the economy depends on environmental wellbeing, and that the current societal trajectory is not ecologically sustainable (European Environment Agency, 2014, p. 5). It acknowledges that everything that is produced comes ultimately from the environment, yet these processes are depleting ecological resources. The document thus calls for resource efficiency improvements (European Environment Agency, 2014, p. 5), whilst advocating the reduction of the losses of materials through the production and consumption processes (European Environment Agency, 2014, p. 6). These aims are admirable. However a critical analysis reveals that even if resources are efficiently used, if the overall trend is towards more extraction, this will not solve the issues. The document therefore reveals itself to be hamstrung in growth-based paradigms, with a finding pronouncing that the EU needs to grow in a smart and sustainable way, with more efficiency around resources (European Environment Agency, 2014, p. 10).

Another critique of this document is in its assumption that 'the consumer and the producer are equally important players in greening our economy' (European Environment Agency, 2014, p. 14). This position does not take a class analysis of the inequalities

between the owners of the means of production and the consumer. However, it does question if we require all the consumer goods on offer, or just the utility or services that the products provide. It discusses 'collaborative consumption' which 'enables consumers to meet their needs leasing, product-service systems and sharing arrangements, rather than purchases' (European Environment Agency, 2014, p. 14). The document reveals an economic naivety in that such 'collaborative consumption' practices would mean a rethink of production 'with less focus on sales and more focus on making durable and repairable products' (European Environment Agency, 2014, p. 14). When taking the political economy perspective, this is in contradiction with the very *raison d'être* of capitalist economies, which is to create a surplus. If such economies switched to collaborative consumption and sharing, the system would find itself in crisis very quickly as capital circulation slowed down. The document also assumes a technology fix in that it points to the internet and social media to facilitate this type of consumption with the introduction of borrowing tools and 'clothes libraries' (European Environment Agency, 2014, p. 14). Even if such initiatives work, they are on a small-scale basis, operating overall backdrop trending towards increasing consumption because the economic system requires it.

However, the document is progressive in that it reinforces the notion that most of the products on the market do not cover both production and environmental costs, including health costs (European Environment Agency, 2014, p. 46). It stresses that nature has given its gifts for free, without any reciprocal requirement to tend to it. It suggests that this externalisation of nature is a fundamental weakness in the economic system and problematises how it is not easy to remedy this situation under current formulations (European Environment Agency, 2014, p. 46). The first issue is the difficulty in ascribing a value to an ecological good, which can vary by region. A higher price may thus be put on clean air in a polluted region than in a clean one, for example. The second difficulty in this economic formulation is in that even if costs were ascribed, a dramatic introduction of those costs would potentially cause a crisis in the economic system. Taxes on natural goods would require gradual introduction as 'a quick switch from a system where natural services are free of charge to one with all costs included would be quite socially controversial' (European Environment Agency, 2014, p. 46). The document does acknowledge that despite the potential introduction of taxes, a market actor can influence the whole market (European Environment Agency, 2014, p. 46). This document sees this as a positive, staying away from controversy of discussing downsides to such oligarchical actors, for example, how the fossil fuel companies are the relevant actors powerful enough to intervene in environmental matters, and unlikely to play a positive role. Rather, it proposes that 'for some green technologies and products, public authorities' decision to switch to these technologies has enabled them to penetrate the market and compete against established players' (European Environment Agency, 2014, p. 46). Thus, massive market players are seen in a positive light, and the dirtier, fossil lobby is ignored. However, notwithstanding this, the document at least attempts to bring ecology into economics and suggests it is progressive to do so.

7.3.1. Summary

This document is firmly within the realm of maintenance of the growth-based system, and unproblematically accepts this as a given. It also flattens out issues of power, declaring the producer and consumer equally liable for pollution and ecological issues. This is problematic in the light of our critiques. However, it is an attempt to discuss ecological matters to extend the 'business as usual' logic into a more rounded view of how the economy utilises

natural resources, and how society can be nudged in the direction of ecosystem sustainability.

7.4. European council conclusions on 2030 climate and energy policy framework 2014

The European Council Conclusions on 2030 Climate and Energy Policy Framework 2014 is important for our discussion as it was the document that requested all countries to supply ambitious policies before COP 21 in Paris. It sets out the main targets for GHG emissions reductions which in the main is a binding target of at least 40% reductions on 1990 levels (European Council, 2014, p. 2). It outlines the Emissions Trading System as the main mechanism to achieve these reductions, whilst allowing for poorer states within the EU certain allowances up to 2030 (European Council, 2014, p. 3). It also ensures that the ETS allocates resources for infrastructure modernisation of these states. With respect to transport, the document includes a request for research into a 'technology neutral' approach for the reduction of emissions. It also stresses how the lower mitigation potential of the agriculture and land use sectors needs to be acknowledged. However, it requests the research into 'sustainable intensification of food production' whilst mitigating greenhouse gas production (European Council, 2014, p. 5). However this framework report fails to acknowledge that the proposed intensification of production is not necessarily going to involve more sustainability. Nonetheless, it sets up binding targets on energy use, to encompass at least 27% renewable across the EU by 2030, whilst not preventing member states from more ambitious targets (European Council, 2014, p. 5). It again stresses that governance is important here, with the need to develop a 'reliable and transparent governance system without any unnecessary administrative burden' (European Council, 2014, p. 10) to support these energy goals.

7.4.1. Summary

This document is important for its role in applying IPCC findings to generate tangible policies for GHG emissions reductions. However, it is couched in the assumption that intensification of production can be reconciled with sustainability. This is a point on which this article disagrees by suggesting that such moves are mere fixes that may defer crisis but not resolve it. However, it acknowledges that a move towards more sustainable energy mixes is a necessary and positive step.

7.5. Review: key points for planning

From this analysis of some key EU level documents, some key points for planning emerge. One theme that emerges is in how the EU-level documents see connected roles for citizens and government actors with respect to mitigation strategies. Another point of interest is evidence of a willingness to problematise conventional growth-based assumptions of economic development, and to critique consumerist economics and the role of advertising. These are all progressive in terms of potential discussions that can occur in the planning domain, in that these selected EU documents when taken as a whole, foreground the need for a range of socioeconomic pathways to mitigate climate change and move towards sustainability. While the underlying growth paradigm is, unfortunately, to the fore, there is an aspect to these documents that is critical of the 'business as usual' stance. There also exists some degree of creativity in thinking about alternatives such as the small-scale initiatives that are outlined as case studies. This indicates that for planning, there is an openness at this level to empower citizens, government actors and indeed planning itself to think creatively about responses to consumerism, waste and growth.

8. National policy conflicts

Thus far, this article has identified high-level and generalised conflicts between economic and ecological imperatives within selected international and EU documents. It is therefore not surprising that at the national level, there can also exist a plethora of conflicting policy aims and agendas around ecological matters. Indeed, while a nation-state can either have obligations to respond to climate change and adapt to it, the research has tended to focus on responses at the international scale (Bulkeley, Edwards, & Fuller, 2014). Not only are national policy responses and conflicts largely neglected, but within that sphere, urban spaces within states can be sites of uneven distribution of both the rights and responsibilities pertaining to climate change responses (Bulkeley et al., 2014). The national level is therefore a significant site for investigation into policy conflicts, and the planning options deemed available in the national context.

Having looked at general policy frameworks at international and EU levels, we now apply those frameworks in the context of an EU member state that is characterised by its geographical peripherality, late development and tendencies to adopt strong neoliberal policies. When analysed by way of case study that is replicable but adaptable at the level of a state, it is possible to switch focus from generalised tensions to the study of specific key sectors, in order to ascertain to what degree conflicting priorities occur between economy and ecology, and indeed how these conflicts pertain to the domain of planning. It is suggested that such a case study can be applied to an analysis of any number or type of states, but is particularly relevant to states that have experienced an acute dovetailing of financial crisis and ecological challenges. It is also suited to states that, despite the failings of strong neoliberalism, continue to adopt neoliberal strategies in the hope of achieving a 'path to economic nirvana' (Boland, 2014). This is while such states fail to heed warnings that such strategies amount to a "dangerous obsession" for spatial planning' (Boland, 2014). Ireland is such a state and is therefore the subject of our state-level analysis.

Ireland is a small, peripheral state with a population of approximately 4.6 million. Its relatively small size and impact as an EU member state would not, this article acknowledges, ordinarily warrant special attention or special case status. However, the state disproportionately rose to renown for its dramatic demotion from neoliberal poster child to 'the eye of the storm' of crisis within the Eurozone area (Preston & Silke, 2014). Indeed, the state underwent such a severe economic downturn after the 2008 crash as to warrant, like the much larger states of Portugal, Italy, Greece and Spain (collectively known as the 'PIIGS') a 'troika' of financial actors from the International Monetary Fund, the European Commission and the European Central bank, to issue a 'bailout' of funds to stabilise the economy (Ó Riain, 2014). This came about in part due to the Irish government's prior decision to issue an ill-thought-out blanket guarantee on what subsequently emerged as 'bad' or 'toxic' banks. This was a typically neoliberal response to the crisis, where the accumulated debt from dealings, risks and bets of private financial entities were socialised and made the responsibility of Irish citizens. The extent to which the Irish banking and property sectors had acted with disproportional influence within the Eurozone came to light in figures released in 2013 which revealed that 42% of the Eurozone banking crisis was paid by Ireland (Taft, 2013). Per capita, this amounted for 25% of GDP, or an absolute amount of close to €9000 Euro per person in Ireland.

Whilst in part the wider global structural crisis influenced the Irish economy, a further way in which the Irish case is significant for our discussion was in the manner in which its spatial planning policies resulted in an oversupply of property during the economic

bubble known as the ‘Celtic Tiger’. A deeply conservative revolution in the 1920s left the remnants of a political system that influenced planning in such a way that it ‘has always been weakened and compromised by localism, cronyism, and corrupt political practices’ (Kitchin, O’Callaghan, Gleeson, Keaveney, & Boyle, 2012, p. 1305, also see Breathnach, 2010). Thus, with this deeply embedded institutional framework, it is little wonder that when the extensive liberalisation of the Irish economy occurred during the ‘Celtic Tiger’ years, the planning domain was also influenced in this direction, involving a speculator-led planning process characterised by short-termism and loose regulation characteristic of neoliberal strategies (Kitchin et al., 2012, p. 1306). This undermined the somewhat progressive National Spatial Strategy which sought to decentralise government departments from the capital city, whilst investing in infrastructural ‘hubs’, which were to include digital development. Indeed, during this time especially, the planning system ‘became beholden to development, being progrowth in orientation with a presumption for development operating, and was consistently undermined with localism, clientalism, cronyism, and low-level corruption’ (Kitchin et al., 2012, p. 1314). Thus, whilst despite an aspirational spatial strategy was in place, this lacked in application due to ‘a lack of joined-up planning between local, regional, and national strategies’ (O’Callaghan, Boyle, & Kitchin, 2014).

The Irish case is therefore significant, as the state has made efforts to engage in spatial planning, yet in the context of the adoption of neoliberal ideology. This makes the spatial and urban context to planning, a rich one for investigation. Indeed, if neoliberal ideology sees the state ‘shrinking’ in responsibility for responses to climate change, the responsibility of various actors including those outside the state comes into focus (Bulkeley et al., 2014). Thus, when actors such as the Dow Chemical company, and HSBC are seen as actors driving responses to climate change, there needs to be a critical appraisal of how these actors are shaping discourse on the range of policies available to respond to climate change (Bulkeley et al., 2014). For example, the corporate voice is more likely to advocate policies that do not threaten accumulation, and is thus likely to be in the range of the ‘business as usual’ scenarios. Indeed, when industrial and corporate actors influence climate policy, this has implications for democratic participation, where participation can not be assumed to be ‘mediated through democratic channels and bound up with notions of accountability and the public good’ (Bulkeley et al., 2014, p. 36). This implies a shift in the responses available as corporate actors foreground solutions that protect their accumulation strategies.

In the Irish case therefore, when the larger global financial crisis unfolded, a perfect storm of neoliberal banking and financial practices dovetailed with clientalism and corruption in planning, along with a general tendency to deregulation in both sectors, despite an aspirational spatial planning policy. Ireland is therefore a significant case to analyse in terms of its reactions to growth, and the tensions of restoring growth with those of ecological and planning factors. Indeed, a third factor in including this case is that despite being a small country, Ireland is a significant actor in terms of climate change, due to its proportionately high percentage of GDP output from agriculture which is twice the EU average. It is estimated, for example that the agri-food sector comprises 7% of Irish GDP (Teagasc, n/d). The tensions between active and intensifying growth in this sector, and balancing ecological sustainability are therefore to the fore in this state. This has been exemplified in a contradictory position, not uncharacteristic of politicians, taken by the prime minister of Ireland, Enda Kenny. When Kenny delivered a speech at the New York UN climate discussions in September 2014 he made pledges to make tackling climate change a priority (Kenny, 2014), before returning to the EU to plead in October for special dispensation for emissions

reduction targets on account of Irish agriculture (RTE News, 2014). Thus, whilst an actor in the EU context, the Irish response to carbon emissions is one that does not challenge existing neoliberal ‘sustainable development’ paradigms that seek for a market-based solution. Rather, the Irish response to its relationship with carbon can be seen as typical of the ‘less than progressive side to carbon regulation in terms of reinforcing existing social and spatial inequalities, extending the reach of market environmentalism, and strengthening the power of state and capital at the expense of consumers, workers and interests in social and spatial equity’ as described by While, Jonas, and Gibbs (2010, p. 77). Thus, at the national level, Irish policy is an exemplar of national policy within the EU that is fraught with conflicting positions.

This section therefore uses the Irish case to investigate a number of key policy documents across three economic sectors, those of (1) food/agriculture, (2) transport/travel and (3) ICTs (information and communications technologies). These economic sectors have been chosen due to their existing policy relevance as areas of special attention for economic development by successive governments. First, however it contextualises the overall Irish climate policy landscape by overviewing the Climate Action and Low Carbon Development Bill 2015. This bill is a long-awaited successor to a prior draft that was widely critiqued for its failure to include binding targets for emissions reductions. However, this bill has changed little from the prior draft and still has not included binding targets. It does, however include a commitment to ‘take into account any existing obligation of the State under the law of the European Union or any international agreement’ (Oireachtas, 2015, p. 5). This at least acquiesces that Irish policy will supposedly not flout binding targets from the EU or UNFCCC that may be forthcoming. Obvious though it is that at a political level, this formulation is a most blatant display of side-stepping, nonetheless it locks the Irish state into EU-level binding targets.

In line with some regional and international documents, this bill also perceives the issue of climate change solely within a growth-based economic paradigm. It locks in the need to protect growth, in that the minister and government, as well as having regard to international targets also will need to have regard to ‘the need to promote sustainable development, [. . .] the need to take advantage of environmentally sustainable economic opportunities both within and outside the State, and [. . .] the need to achieve the objectives of a national mitigation plan at the least cost to the national economy and adopt measures that are cost-effective and do not impose an unreasonable burden on the Exchequer’ (Oireachtas, 2015, p. 8).

The obvious subtext here is that it was perfectly acceptable for finance to place such an unreasonable burden, but not the ecosystem. Mitigation and adaptation plans are outlined in the bill, to be reviewed every five years, along with the instigation of an expert group, called the ‘National Expert Advisory Council on Climate Change’. This group is to be made up of independent members along with representatives from the Irish Environmental Protection Agency, Teagasc (the state’s agriculture and food development authority), Sustainable Energy Ireland and the Economic and Social Research Institute. This group is to report annual findings to the minister for the environment, who is charged with addressing the Irish parliament with a yearly ‘transition statement’. This arrangement has problematic dimensions, in that the chair and other members are to be nominated by the minister. This potentially reduces the possibilities for rounded perspectives on climate change or sustainability, or even a perspective that questions the prevailing growth-based climate policies, let alone more alternative or radical ones. The formation of the expert group also leaves it up to the minister as to whether to even include experts on climate change, let alone social policy or planning experts. Indeed, the first advisory council is led by an

economist, Professor John FitzGerald of the Irish Economic and Social Research Institute ([Department of the Environment, Community and Local Government, 2015](#)). Thus, this national level overview reveals that the domain of planning itself can be excluded if governments act in such a way as to ‘gatekeep’ which actors should or should not form part of climate strategies.

The climate bill has also been severely criticised by non-governmental organisations, one of which, for example, has noted that the bill ‘does not include a definition of low carbon, it doesn’t guarantee the independence of the Council, and it doesn’t include the principles of climate justice’ ([McGee, 2015](#)). It is also watered down by a 24-month delay in implementation, effectively leaving action for 2020 targets until 2017. This is quite patently a cynical political decision, as it will be the ensuing government, not the one who wrote the bill, who will be charged with taxing or penalising defaults on emission targets ([Gibbons & Price, 2015](#)). Yet, the ensuing government, even if committed to prioritising climate change, faces a far more difficult task to meet the 2020 targets from 2017 than if the present government had instigated some measures immediately, as they will be required to concentrate efforts in a shorter time frame. On a micro-scale therefore, Irish policy currently disregards the IPCC observations that acting immediately is more cost-effective and requires less dramatic decisions than deferring action. The overt short-termism also runs contrary to ideas of long-term strategic planning. Thus, in a double-action, the bill both potentially excludes the planning dimension entirely, and defers actions in such a way as to show no regard for strategic planning concepts.

8.1. Food/Agriculture

It is thus evident that the overall climate policy framework in Ireland is beset with conflicts between economy and ecology. Moving on to the sectoral analysis, Ireland presents a case of conflicts between ecological issues and economic sectors, most notably the agri-food sector. This sector contributes €24bn to the Irish economy and is set to rise with the Irish department of agriculture having launched its Food Harvest 2020 programme in 2010 ([Department of Agriculture, Food and the Marine, 2010](#)). This programme aims to increase the value of agricultural output whilst achieving an export target of €12 billion for the sector. This, as the terms of reference of the programme indicate, represents a 42% increase on the 2007–2009 average. This expansion entails in part, the increase of the national herd and its ensuing methane outputs, in order to meet the goal of 20% growth in the beef sector. However, the programme is naively hubristic, suggesting that despite an aggressive growth policy, emissions from this sector can not only be managed, but reduced. The programme acknowledges that ‘a 12% rise in GHG emissions could result from the increased output envisaged in the national dairy herd’ ([Department of Agriculture, Food and the Marine, 2010, p. 23](#)). However, according to the programme, this increase can be offset through ‘research investment’, technology transfer, and ‘advice on management interventions to enhance carbon uptake in soils’ ([Department of Agriculture, Food and the Marine, 2010, p. 23](#)) to be led by the Teagasc research centre. Such vague and offhand remarks even fall short of actually-existing ‘fixes’. They are in the realm of technological dreamware and platitudes to conduct further research. This therefore reveals the lack of integrated strategic planning that foregrounds and makes climate change mitigation an integral part of policy.

In the short term, any promised reductions from the ‘fixes’ have, of course, not borne out, with agricultural emissions showing a 2.6% increase between 2012 and 2013. This, according to the Irish Environmental Protection Agency is in part due to a 2.2% increase in cattle numbers, and a 1.5% increase in sheep numbers ([Duffy,](#)

[2015, p. 1](#)). As critics of Irish climate policy observe with respect to the decoupling of herd growth and emissions:

This manifest nonsense is blown out of the water by data from the Environmental Protection Agency, which show that methane (CH₄) emissions from ‘enteric fermentation’ in Irish dairy cows actually increased, from 101 kg per head per annum in 1990 to almost 113 kg per head in 2012. Methane is a potent greenhouse gas, at least 28 times more powerful as a heat-trapping gas per molecule than CO₂. The reason for the large increase in as few as 20 years? Almost certainly, it’s greater dairy intensification. ([Gibbons & Price, 2015](#))

A 2013 report on the projected economic impacts of climate change on Irish agriculture is likewise justly skeptical, observing that projected impacts to date have been ‘unduly optimistic’. Such optimism has contributed to a justification of the ‘relatively complacent approach of climate policy in relation to the agricultural sector’ ([Flood, 2013, p. 1](#)). The report suggests that changes to rainfall patterns (an increase in winter and decrease in summer), will lead to direct negative impacts on the agricultural sector. Threats such as pests and diseases change their vectors of contagion as temperature and moisture fluctuates, whilst stress through drought or water logging are also threats to crops ([Flood, 2013, p. 5](#)). Likewise, the livestock herd itself is subject to threats and risks of disease, resource supply for animals, water use needs and stress ([Flood, 2013, p. 6](#)). The report suggests that some of these threats are highly likely and have urgent economic costs ([Flood, 2013, p. 8](#)), projecting a total economic cost due to climate change in the region of €2bn per annum by mid-century. In this context, the short-term gains to agriculture by pursuing the intensification under Food Harvest 2020 will quickly be offset should climate change expose the Irish agricultural sector. Thus, the Irish policy landscape with respect to agriculture and climate change is a typical example of *après moi le deluge* thinking. In terms of the role of planning, the policy landscape reveals little or no attempts to mitigate climate change, act sustainably or even plan for the long term, let alone advocate internationally for more stringent climate legislation.

Indeed, a worrying connection between agricultural pressures and the overall Irish climate strategy is evident in a recent call for tenders to assess the mitigation plan promised by the Climate Action and Low Carbon Development Bill 2015. Whilst a request for expertise is welcomed, a worrying precondition for eligibility is a degree ‘in agricultural science or agricultural economics to at least Masters Level’. As the Irish National Trust, An Taisce have observed, ‘whilst there are also requirements for persons qualified in environmental science and with experience of ecology, there is no requirement for experts in energy, buildings or sustainable transport’ ([An Taisce, 2015](#)). The government has therefore worryingly interfered in the gatekeeping and selection process by laying down this precondition. As they further observe of this decision:

The tender document says that four key sectors are to be examined: electricity generation, the built environment, transport and agriculture. Given this list, it is totally unclear why agricultural expertise has been singled out as a required criterion whilst other sectoral expertise has not ([An Taisce, 2015](#))

The agricultural sector in Ireland has a strong lobbying influence. It is evident that this has the potential to influence to an inordinate degree, the climate policy trajectory of the state. The role of planning in this is unclear. However, it does reveal a difficulty regardless of whether the domain of planning itself is influenced by the lobbying or not. If the former, this potentially precludes more stringent emissions strategies. If the latter, the

domain is hamstrung by external actors. This places planning in the unenviable role of having to navigate vested interests, entrenched paradigms about growth and intensification, and powerful lobbying.

8.2. Transport/travel

The second sector to analyse in the Irish context is transport and travel. Between two sectors, transport and agriculture have accounted for 51.4% of total emissions in 2013 ([Environmental Protection Agency of Ireland, 2014, p. 2](#)), making transport a significant sector for analysis. The dovetailing of transport and agriculture is, of course, of significance here too as, if agricultural exports are to be intensified, transportation is needed to get the agricultural goods to ports for onward travel. Thus, in the context of integrated environmental policy goals and strategic planning, the challenge of growth in one sector potentially affects other emissions-producing sectors, even if that sector in an isolated context makes progress in their own emissions.

However, in the Irish context it is, alas, too hopeful to assume that the transport sector is forging ahead with emissions reduction, to be stymied by an errant carbon-intensive agricultural sector. The Our Sustainable Future policy document ([Department of Environment, Community and Local Government, ND, p. 57](#)) reveals that the transport energy consumption relative to GDP in Ireland is very much coupled. The graphic representation of this correlation is set against a backdrop of EU-15 and EU-27 countries which fare better in decoupling economic growth from transport energy consumption. The overall trend of transport energy consumption amongst EU-15 and EU-27 countries is downward, despite a slight increase between 2008 and 2009. However, Ireland's economic boom is rendered visually as a spike in transport emissions between 2004 and 2007, peaking well above both the EU-15 and EU-27 levels. National statistics confirm this trend, with the total energy consumption from transport in Ireland increasing year-on-year from 1996, peaking in 2007 to only decline due to the economic crisis, yet remaining well above 1990s levels. Thus, in Ireland the connection between economic development and GHG emissions from transport is very much coupled. The Sustainable Energy Authority of Ireland (SEAI) likewise acknowledged this, with their Energy in Ireland 1990–2013 report observing that 'transport energy use increased 2.5% to 4,279ktoe, 25% below the peak in 2007' ([Sustainable Energy Authority of Ireland, 2014, p. 4](#)).

The Smarter Travel policy document is a key transport policy document for the Irish state, running from 2009 – 2020 and therefore emanating at a time of crisis ([Department of Transport, Tourism and Sport, 2009](#)). The policy contains a total of 49 actions with regard to sustainable transport. These actions are clustered into four main aims. The first aim is focused on reducing private car use and promoting smart travel by 'focusing population growth in areas of employment and to encourage people to live in close proximity to places of employment and the use of pricing mechanisms or fiscal measures to encourage behavioural change' ([Department of Transport, Tourism and Sport, 2009, p. 12](#)). Whilst admirable, this aim is contested, with an EPA report concluding that the legacy of improper and poor spatial planning in the form of urban sprawl and low-density development curtails the potential for integrated, 'smart' or even incremental shifts in transport patterns ([Environmental Protection Agency of Ireland, 2011, p. 17](#)). This report acknowledges that 'structural travel demand is inherently linked to spatial settlement patterns and may be difficult to influence in the short term' ([Environmental Protection Agency of Ireland, 2011, p. 17](#)). Whilst the shift to precarious, part-time and casual labour potentially increases the demand for flexible work locations, the reality for many during the boom was

to increase their distances travelled by car, due to employment being concentrated spatially. Thus, the commuter belt around Dublin, the capital city, expanded, along with infrastructural and private transport demand. Therefore, this first aim is indeed curtailed by legacy planning issues, despite the existence of a legacy 'spatial strategy' which hubristically promised a massive decentralisation and development of 'hubs' to reduce spatial concentration in Dublin ([Irish National Spatial Strategy, 2015](#)).

The second cluster of aims are centred on providing alternatives to the car through 'a radically improved public transport service and through investment in cycling and walking' ([Department of Transport, Tourism and Sport, 2009, p. 13](#)). Whilst the fruits of this cluster are tentatively emerging in the areas of walking and cycling through the extension of the Dublin Bikes scheme and greenways for cycling, the public transport situation has not greatly benefitted from these aims to date, nor has it significantly improved outside Dublin. Furthermore, in 2015, the National Transport Authority (NTA) published a list of bus routes to be tendered for privatisation. These routes were exclusively operating in outlying areas of Dublin, did not serve the city centre, and were therefore peripheral routes, likely a burden on Dublin Bus which therefore wishes to offload them. However, the privatisation of these routes will more than likely result in the privatised company either hiking fares to make them profitable, reducing the capacity of services, or worst case scenario, scrapping the service altogether if the route is loss-making. This further undermines the lofty ambitions of spatial planning to encourage so-called 'smart' or sustainable transport.

The third cluster of aims targets efficiency of transport through 'improved fleet structure, energy efficient driving and alternative technologies' ([Department of Transport, Tourism and Sport, 2009, p. 13](#)), while the fourth cluster of aims foreground the strengthening of institutional arrangements to deliver on these aims. While these aims are valid, the growth and intensification of agriculture alone suggests that these aims need to be urgently addressed. However, in the light of proposed privatisation of some bus routes, this analysis suggests that the aims of fleet structure improvements are potentially compromised by the bottom line of profit. Thus, privatisation of transport still needs strong environmental regulatory practices, lest shortcuts for profit at the expense of emissions reduction is to the fore. Therefore, the 'siloing' of policy areas needs to be addressed, with policy integration necessary between sectors of the economy.

8.3. ICT

In the Irish context, ICTs (information and communications technologies) are also an integral part of green development and the so-called green economy. ICT competencies are seen as key to the development of the green economy at a policy level ([Department of Environment, Community and Local Government, ND., p. 80](#)). These competencies are seen as an area that 'can realise jobs and growth opportunities both domestically and internationally' in the context of the green economy ([Department of Environment, Community and Local Government, ND., p. 80](#)). There is therefore no critique about the ecological cost of this sector, despite the Sustainable Energy Authority of Ireland pointing to ICT services as a key driver of increased electricity usage in the period 1990–2013 ([Sustainable Energy Authority of Ireland, 2014](#)). This report found an increase of 128% in electricity consumption in services, with its share of total consumption rising from 24% to 42% in that period. Their report is categorical in stating that 'this growth is fuelled by the changing structure of this sector and the general increase in the use of information and communication technology (ICT) and air conditioning' ([Sustainable Energy Authority of Ireland, 2014, p. 80](#)). What is not therefore observed in Irish economic policy on sustainable or so-called green growth is that it

requires an intensification of energy to fuel the ICT services on which the 'sustainable future' depends. Globally, the energy use from these services is typically fuelled by coal. Indeed, a 2013 report on big data and network infrastructure points to this in its very title *The Cloud Begins With Coal*. Whilst the report itself is sponsored by the National Mining Association and the American Coalition for Clean Coal Electricity and is therefore somewhat brash about how coal facilitates 'our wonderful cloud' (Schiller, 2015), the celebration of the dovetailing of ICT and fossil fuels is notable. Indeed, a commentary notes that the cloud generates significant revenue for electricity companies (Schiller, 2015) and is therefore duly celebrated by such corporations.

ICTs are positioned in the Irish context as suitable areas for sustainable development, including in the process of 'green public procurement' (Department of Environment, Community and Local Government, ND., p. 35). Presumably the contribution of ICTs to green public procurement is in the adherence to the WEEE recycling programme, and not necessarily in the efficient reuse and repurposing of existing ICT infrastructure. For example, a site-wide contract for procurement from a global PC manufacturer can result in a situation whereby some older machines are eventually past their peak, but nonetheless identified by the client as suitable for repurposing with the install of an open-source operating system to replace the pre-installed proprietary operating system. However, under the contract with the PC manufacturer, this can be forbidden due to intellectual property and copyright issues between the hardware manufacturer and the software operating system manufacturer. Thus the machines are not repurposed but scrapped. In this instance (based on events from the author's prior career in IT networking), green procurement is merely an idealistic aim when it stands in the way of intellectual property rights of ICT software and hardware manufacturers. Thus, with the best will in the world at a strategic planning level for green procurement, the concentration, conglomeration and shared business interests of monopoly corporations can be a strong countervailing force.

The Irish context therefore reveals an ideology whereby ICTs are seen as low-carbon and associated with 'soft' and 'weightless' services rather than heavy manufacturing. However, from manufacturing to consumption and then end of life, ICTs have a very distinct and significant material impact on the ecosystem. Issues of both technological and psychological obsolescence are significant factors in the environmental impact of ICTs, not least in how 'today's digital devices are made to break or become uncool in cycles of twelve months and counting down' (Maxwell & Miller, 2012, p. 2). Thus, the environmental impacts of ICTs may not be directly felt in Ireland as it devotes its support to software and games development. Indeed, 'it is difficult to comprehend the scale of environmental destruction when technology is depicted in popular professional quarters as a vital source of plenitude and pleasure, the very negation of scarcity and dross' (Maxwell & Miller, 2012, p. 4). Intimately connected with the imperatives of consumerism, the immediacy of access to applications, networks and communication channels afforded by technology divorces concerns from long-term assessment of the harmful ecological effects of these devices. A further significance of ICTs is that the communications on which these devices run are themselves ephemeral, ideas-based, social and creative. This symbolic communication, facilitated by ICTs therefore 'mak[e] it hard to perceive its material connection to ecological decline' (Maxwell & Miller, 2012, p. 2). This is true for policymakers and planners as well as end-users.

8.4. Summary

This section has reviewed national policy with respect to three specific domains of economic activity deemed significant for the

Irish government to develop. It revealed the backdrop of poor, corrupt and clientalist spatial planning that took place in the context of the adoption of neoliberal strategies. It has revealed that contradictions and tensions between economic development and ecosystem sustainability are rife in the policy landscape in Ireland, with little attention paid to assessing new and imaginative ways of smoothing these tensions. The agricultural sector is particular riddled with contradictions, with little more than 'research' and 'technology transfer' offered as ways to offset increased carbon and methane emissions from the planned intensification of the agri/food sector. Likewise, contrary to policy suggestions from the EU level which strongly pointed to the need for moving beyond the siloing of policy, the Irish context fails to acknowledge necessary intensification of the transport sector that is implied by the intensification of agriculture. Again, the technology fix is in evidence, with the Irish policy landscape assuming that ICT is cleaner and greener than manufacturing, whilst failing to acknowledge significant energy demands from this sector.

8.5. Review: key points for planning

The analysis of the Irish context reveals that cross-sectoral tensions exist between ecological and economic imperatives. Implications for planning are therefore of the same order of magnitude as seen when discussing the regional and international contexts. The analysis reveals that planning is at the forefront of the tension between economic and ecological imperatives. In the Irish case, this is further complicated by a parochialism and clientalism that exists societally in general and is characterised broadly by a relatively weak civic and public sphere. This has been eroded by neoliberalism, which, in general sees not only state actors but industrial and corporate actors having a significant input into planning strategies. Planning is therefore potentially constrained by these myriad conditions, making it challenging for the domain to transcend the cultural norm of clientalism and corporate influence, in order to redress the debate to matters of the public good and democratic deliberation. This case of one specific national actor, and the local issues therein, foreground the need to perform these studies specific to states and local areas, in order to ascertain the particular cultural and societal nuances that may to an extent drive how climate change mitigation and adaptation is planned.

This concludes the analysis of national sectoral policies with respect to environmental dimensions. We therefore move on to a discussion of implications for planning in terms of both challenges and opportunities in the next section.

9. Discussion

This article has drawn on selected policy documents at international, regional (EU) and national (Ireland) levels to assess the extent to which fixes, and the techno-finance fix, are in evidence as solutions to climate change adaptation and mitigation. This has been done so that the domain of planning is offered, to an extent, a 'map' of the policy landscape, and also a method for analysing local contexts that are more particular to individual states or local regions therein. The analysis has revealed a tendency for policy documents to operate broadly within the assumption that the current economic paradigm of accumulation will continue in the face of challenges to accumulation from climate stress. Based on this assumption, many policy documents therefore foreground how investment in technologies through markets can bring to society the necessary strategies for climate adaptation and mitigation. The article suggests that it is naive to assume this. Drawing on the concept of fixes, it offers the concept of the techno-finance fix to argue that solutions from within the system are not

likely to be radical, comprehensive or indeed, effective. It has argued that the dominance of the techno-finance fix discourse, amongst other discourses of fixes, is embedded in the neoliberal ideology. This has implications for planning, in the forms of both challenges and opportunities for change. It is to these matters we now turn.

9.1. Challenges for planning

From a survey of the planning literature, it is evident that opportunities and challenges exist, particularly at the level of urban planning, with respect to planning for climate change and sustainability. For planners, the issue of climate change is an interdisciplinary one, traversing economic, social, political, cultural and technological aspects of urban planning (White & Whitehead, 2013, p. 1326). Indeed, the domain of planning for climate adaptation or mitigation is not solely the realm of international or national-level actors, but of local governments and municipal actors, often in tension with national governments, particularly for fiscal resources (Sharp, Daley, & Lynch, 2011, p. 433). Likewise, at the urban scale, issues of social justice, rights and responsibilities play out as aspects of the realpolitik of climate change (Bulkeley et al., 2014). Yet, historically, the city has been under-researched as an important site in climate change studies. Rather than cities functioning as fragmented and therefore unimportant actors in climate change mitigation, a growing body of research is indicating that urban carbon initiatives are significant actors in carbon governance. Therefore there is a need to both consider cities and also understand to what extent their responses and projects are effective (McGuirk et al., 2015). This is a key concern and challenge for the domain of planning.

As this article has so far illustrated by analysing existing climate policy documents, one key overarching challenge for planners is the economic system dominated by neoliberalism. This system influences climate policies in urban settings in such a way that 'contemporary adaptation policies are being framed by neoliberal practices of market-oriented governance, enhanced privatisation and urban environmental entrepreneurialism' (Whitehead, 2013, p. 1348). This 'neoliberal urban environmentalism', whilst couched in lofty ideals and 'rhetoric of urban care, defence and protection' (Whitehead, 2013, p. 1349) is more connected to maintaining economic growth, ecological modernisation, deregulation and privatisation of the urban space, than it is to foregrounding the protection of the ecosystem. At best, such a system, even when engaging with ecosystem protection, does so with the priority of maintaining the economic status quo. Indeed, while ecological modernisation (EM) discourses centre around the relationship between ecology and society, they tend to be framed with a techno-optimism and a faith in existing economic paradigms to provide solutions. This is acceptable to politics and policy as it 'avoids triggering opposition from mainstream actors and established vested interests' (Newell, Boykoff, & Boyd, 2013, p. 85). It is key that the domain of planning remain alert to this tendency to avoid opposition, which in turn encourages the vested interests that can work counter to radical discourse on planning for climate change. It is also important to be mindful of the tendency for neoliberal ways of governing to co-opt previously admirable goals, such as sustainable development, which has become little more than ideology in contemporary debates (White et al., 2010).

More specifically, the management of carbon poses different challenges for planning, particularly when the dominant means through which carbon may be conceivably managed is through the so-called carbon economy. The connection of this carbon economy to global finance is evident in how the value of carbon credits declined when the global financial crisis emerged. Despite this vulnerability, "faith in carbon markets as a key element of

global responses to the threat of climate change remains strong" (Newell et al., 2013, p. 2). The naturalisation of the market discourse, whilst prominent, was not always the dominant way in which attempts were made to regulate carbon. Prior to that, a nascent international 'command and control' process of emissions regulation emerged. However, opposition to this came from industries whose accumulation of capital would be affected by such regulation. Indeed, 'the ramifications of regulating energy supply and use to the world's economy, upon which growth depends, made climate change a "wicked" policy challenge' (Newell et al., 2013, p. 2). Thus, in the emerging neoliberal climate, markets were seen as the most politically acceptable alternative to command and control. Indeed, the market-based solution became the only way to persuade the US to become involved in regulating emissions, despite the US then failing to ratify the Kyoto treaty. A key concern for planning is therefore how the notion of a market-based 'fix' to carbon emissions became logical under increasingly neoliberal conditions, where such a 'fix' would not have been either 'politically viable or imaginable even 20 years earlier' (Newell et al., 2013, p. 3).

Thus, it is important for the planning domain to remain critical of the mechanisms of neoliberal urban environmentalism, the carbon economy, and EM discourses, and to engage actively with critical urban theory, such as that of Whitehead (2013), Brenner (2004, 2009), and social movement theory such as Aylett (2010). The strengths of critical urban theory lie in the way in which 'rather than affirming the current conditions of cities as the expression of transhistorical laws of social organisation, rationality or economic efficiency, critical urban theory emphasizes the politically and ideologically mediated, socially contested and therefore malleable character of urban space' (Brenner, 2009, p. 198). Thus, the neoliberal project of urban environmentalism, and the naturalisation of neoliberal ecological practices for growth and accumulation, may be critiqued and challenged. When this challenge is augmented by an awareness of technological determinism, and its counter in the domain of science and technology studies (STS), a more rounded perspective on the socio-technical challenges may inform the domain of planning. Particularly strong in the domain of STS are the works of Pinch and Bijker (1984), Bijker (1995), Bijker and Law (1992), MacKenzie and Wajcman (1999) and Scharff and Dusek (2014).

Connected with the naturalisation of neoliberal urban discourses and technological determinism are notions of 'spontaneous decarbonization' (Davis, 2010) and 'autonomous' or 'automatic' adaptation to climate change (Whitehead, 2013, p. 1358). Such perspectives assume that free-market conditions will naturally and spontaneously support decarbonisation and GHG reductions. Thus, rather than acknowledge that the free market is inherently crisis-prone, this ecological dimension to neoliberalism advocates more freedom in the market with respect to climate change. Thus, under neoliberal policy, climate change and sustainability can be uncritically woven into the existing dominant growth and accumulation paradigm.

Indeed, the role for urban planners under such schema is how they 'must address the problems of land consolidation, complex historical tenure arrangements and liens in order to make it easier for private investment to flow into the brownfield sites that are likely to require adaptive redevelopment' (Whitehead, 2013, p. 1360). This is despite the critical perspective that observes how 'already existing neoliberalism is actually the source of the financial and planning problems confronting adaptation regimes rather than the basis for their resolution' (Whitehead, 2013, p. 1361). In the light of such critique it is naive to assume that continued neoliberal policies can address the issues that previous rounds of neoliberalism introduced into the domain. Yet, such is the rhetoric of this system that even despite the massive failures

made apparent in 2008 and still unfolding, solutions are dominantly couched in economic terms.

An immediate manifestation of the ecological failures of this system are seen where ‘transition to cleaner energy systems has “stalled”, with societies ‘locked in to fossil fuels and the economic growth and lifestyles that they support’ (Rutherford & Coutard, 2014, p. 1355). There exists an oversimplification regarding the conceptualisation of energy use, transition and fuel types, especially with respect to the urban context, which in turn simplifies the complexities between energy use and society. Indeed, cities are seen as little more than ‘end points of a supply chain to which one merely has to deliver the flows’, rather than vast, differentiated sites of energy use (Rutherford & Coutard, 2014, p. 1357). Thus, a more rounded view would see how ‘within the context of ongoing planetary urbanisation, the emerging normative need to formulate local responses to “unsustainable” energy systems highlights that the inherently co-evolutionary relationship between cities and energy must be a more central practical and analytical concern than has been the case to date’ (Rutherford & Coutard, 2014, p. 1356).

The position reflects a viewpoint which places the technological to the fore in ‘an artificial divide between the “social” and the “technical”’ (Rutherford & Coutard, 2014, p. 1361) which generally prioritises the technical over the social, in a blunt determinism that at the least neglects the multilevel perspective of technological change (MLP) (Rohracher & Spath, 2014, p. 1417), let alone viewing cities as part of a nature/society metabolism, or, indeed viewing energy systems themselves as complex socio-technical configurations (Rohracher & Spath, 2014, p. 1417). As discussed earlier, determinism around technology and technical systems masks the complexity of socio-technical systems, often feeding into and dovetailing with neoliberal ‘fixes’. Thus, for the purposes of our discussion, the dominance of the rhetoric of both economic and technical ‘fixes’ in the techno-finance fix proposed in this work, influences policy and planning options to the exclusion of non-market and non-technical dimensions. However, whilst dominant, these fixes are not total and there exist opportunities within planning to support and foreground alternate transition, mitigation and adaptation pathways. It is to those we now turn.

9.2. Opportunities

Notwithstanding the issues with dominant narratives in influential policy arenas, there does exist scope in planning discourses to assert positions beyond market solutions to climate change. Analysis of solutions from international to regional and local areas are helpful in fostering an overall planning and policy landscape that looks beyond market-based, neoliberal, or techno-finance fixes. Assessing the entire gamut of potentialities is important to transcend the typical top-down or bottom-up approaches in isolation. Rather, in articulating potential solutions across the entire range of actors and institutional remits from the international to the regional, national and local, this article suggests that a more robust awareness of multi-scalar opportunities can be afforded at any level. Indeed, a move beyond the siloing of opportunities has the potential to widen the discourse beyond techno-finance fixes to work towards robust climate policies that are also socially progressive, foster equality, and protect regions most vulnerable to climate change.

9.2.1. International

At an international level, Piketty (2014) advised that a global tax on capital would offset the tendencies of capitalism towards inequality. Yet it has not been enacted, as the market actors themselves are key to ensuring its implementation and are thus highly unlikely to instigate such a move for any other reason than if

inequality became damaging to their bottom line of profit. Therefore, in the absence of market actors self-regulating, other actors, including state actors, have a role to play in regulating capital accumulation. Thus planners in the public sector, local authorities, at a state level and their multilateral equivalents comprise an institutional space in which to develop more assertive roles in terms of non-market strategic decisions. The state has a role in that it can encourage or respond to new social movements that are outside the market, yet encourage climate-friendly practices. Planning actors within this can likewise choose non-market, rounded and holistic practices that can support climate mitigation strategies from the ground up. Indeed, a paradigm shift is needed in policy planning in the light of stark projections on climate change. Therefore an approach to planning that incorporates new and necessary alternative measures is called for and to be welcomed.

One such example is in acknowledgement of societal capabilities broader than the ‘rational actor’ and ‘utility maximiser’ default of the classical economic paradigm. In a recent article, Nobel prize winner Robert Shiller examines the role of idealism in climate change mitigation (Schiller, 2015). His work argues that moral concerns are far more key aspects to human behaviour than the ‘utility maximising’ premise that classical economics suggests. Therefore, it is idealistic in economic terms to ask citizens and states to take a moral approach to climate change, but not naively so. He cites the example of the city of Copenhagen where citizens moved from being car-dependent in the 1970s to now utilising the bicycle. For Schiller, there is no reason why the basis for this transformation could not be scaled up to a state level. Whereas the ‘free rider’ approach of classical economics argues that most states parasitically reap benefits of other states’ actions on climate change, this approach suggests that moral behaviour and decision making is more fundamental, rather than idealistic. Shiller suggests that by appealing to higher ideals, societies can be positively motivated to tackle climate change.

Indeed, Hodgson likewise observes how experiments on co-operation reveal ‘that something special about our species gives us a greater disposition to cooperate’ (Hodgson, 2012, p. 60). With respect to the role of co-operation in economics however, he notes that ‘this “something special” is not found in economists’ general notions of rationality or utility maximisation’ (Hodgson, 2012, p. 60). Therefore, appealing to the level of self-interest, the economic bottom line and consumerist tendencies may not be the most effective ways to tackle climate change. However, for the planning domain, it is important to note that such thinking goes hand in hand with neoliberal ideals in their naturalisation of the so-called ‘selfish gene’ and ‘greed is good’ mantras. As neoliberal capital dominates, as does such ideology with respect to human nature. Thus, the work of Dawkins inevitably allies itself with such ideology in that Dawkins argues that we are, at our core, selfish, in that ‘genes and individuals are described as selfish’ (Hodgson, 2012, p. 107). This perspective becomes a dominant one reflected in economic thought with respect to the ‘pleasure maximising’ and self-interested individual. However, for Hodgson this account is incomplete as Dawkins argues that the way out of this innate selfishness is to ‘try to teach generosity and altruism’ because ‘we alone on earth, can rebel against the tyranny of the selfish replicators’ (Hodgson, 2012, p. 107). The issue with this account is that:

if natural selection provides us with selfish dispositions, then why should we be inclined to “combat” selfishness or “teach generosity and altruism,” unless they are some sort of elaborate selfish ruse to get the upper hand? Why should nature-red-in-tooth-and-claw rule in one sphere but not another? Furthermore, any inclination “to teach generosity and altruism” and any capacity to “rebel” against our own selfishness is

unexplained. We are asked to overturn natural selection in our domain, but with unspecified human powers whose evolution is a mystery. What evolved dispositions would we recruit in this rebellion against evolution? (Hodgson, 2012, p. 107)

Thus, when a more rounded perspective is brought into economic behaviour, a contrary position emerges, whereby just as much as a 'selfish gene' exists biologically, so does an 'altruistic' or cooperative gene. This makes non-market incentives, discourses and appeals important in planning for climate change. Such initiatives ground the idealism of the 'altruistic' gene in targeted actions that appeal to those innate faculties whilst still remaining practical with respect to the need to act.

Indeed, Shiller hypothesises that the so-called 'Copenhagen theory of change' can potentially be applied to entire states in climate change action. Thus, rather than other states adopting a 'free-rider' approach, they may form a 'climate club' of merit where the states co-operate, 'agree to create incentives for people to reduce carbon emissions, while also erecting tariff barriers on imports from countries that are not members of the club' in a 'virtuous circle' of state-level co-operation (Schiller, 2015).

Likewise at the international level, the likelihood of the proprietary technological dreamware coming into operation and keeping the economic status quo trundling on is also contested. Indeed, there is an argument that information and communications technologies (ICTs) are themselves posing a challenge to the very foundations of accumulation on which capitalism rests. As much as ICTs show how capital tries to harness 'value' through intellectual property rights, they also reveal how little 'value' is captured (Mason, 2015). Indeed, ICTs such as Wikipedia, Creative Commons, and Open Source movements reveal that collaborative production foregrounds the social and co-operative dimension to human behaviour, rather than as utility-maximising actors in the market (Mason, 2015, p. 127). Instead of exchanging value in the capitalist sense, those who participate in many ICT practices are engaging in gift exchange that is a 'symbol of something more intangible: call it goodwill, or happiness' (Mason, 2015, p. 129). This reveals that the assumptions of mainstream economics in terms of rational actors is erroneous. Indeed, rather than human behaviour changing when we are confronted with ICTs and networks, the profound sociability and co-operative nature of humans is foregrounded:

Nothing has changed about humanity. It's just that our human desire to make friends, build relationships based on mutual trust and obligation, fulfilling emotional and psychological needs, has spilled over into economic life (Mason, 2015, p. 130)

Therefore, in terms of what mainstream economics, and neoliberalism, understand about the 'selfish gene', this is radical, disruptive and transformative. Thus, at an international level, major assumptions about the role of ICT require more investigation in terms of the radical potential of ICTs to disrupt accumulation and transition to a different economic paradigm based on co-operation, the 'gift economy' and peer-production.

9.2.2. Regional/local

The spectre of resource constraint in the face of climate change stands at odds with the conditions that allowed neoliberal practices of capital accumulation to flourish. The materiality of carbon-based transport, for example, is predicted to bring about a 'reverse globalisation', whereby the cheap production of goods in the global south will no longer be guaranteed as the ecological costs of transport are increasingly accounted for (North, 2010). Thus, planners may, sooner than later, be required to deal with the end of the 'cheaps' (food, energy, raw materials, labour) that historically facilitated development in the global North (Moore,

2011). At a more local level therefore, there exists scope for experimenting with behaviour change initiatives that support and encourage citizens towards a lower carbon footprint. Indeed, such initiatives at a local scale can transcend critique of individualisation, but can encourage a connection from citizens to publics and politics, and the fostering of collectives that transcend individualised discourses on carbon reduction and behaviour change towards sustainability (McGuirk et al., 2015). Local collective initiatives such as the Grow Your Own (GIY) movement can therefore have a role to play in planning for climate change. This GIY movement foregrounds and supports the production of local food instead of long-chain production. At a planning level, such movements can be supported through low-cost allotment provision, where fallow or disused land is repurposed to facilitate citizens GIY practice. There are thus many elements to the 'virtuous circle' in which planning can strategically support climate mitigation.

One actually existing opportunity takes place at an urban and regional scale to introduce innovative sustainable practices. The Transition movement is complex, in that it is radical and utopian approach to adaptation and sustainability (Mason & Whitehead, 2012). The movement offers counters to the neoliberal securitisation and erosion of freedom through voluntary participation and consensus-building (Whitehead, 2013, p. 1364). Critiques of the transition movement point to its utopian and radical position and the limits of such an approach to persuade dominant actors away from growth-based economic paradigms (North & Longhurst, 2013, p. 1424; North, 2010). Thus, the Transition movement uses markets, which promotes critiques of the movement as hamstrung by the overarching capitalist system. The movement is also thought of as more suitable to rural idyllic ideas of sustainability, but evidence from UK transition towns such as Liverpool and Bristol suggest that the approaches of the Transition movement are also applicable to urban centres. Indeed, Brixton has gone from being 'infamous to famous' in its transition movement, with its own local currency encouraging exchange between local actors (North & Longhurst, 2013, p. 1424).

The Transition movement, rather than being a protest movement, aims to offer positive alternative paradigms that promote societal wellbeing, prosperity and sustainability in the face of what they consider inevitable and necessary changes to energy use (North & Longhurst, 2013, p. 1424). To this end, the movement addresses critiques in that it acknowledges the dominance of the current economic system, whilst building a movement from the ground up that can counter it. Thus, whilst there are large-scale international dimensions to acting on climate change, the movement's stance is that 'faith that governments will act is lacking. Acting collectively from the bottom-up at a community level is therefore seen as the most appropriate scalar response' (North & Longhurst, 2013, p. 1425). In this way, its praxis involves not just a protest but a construction of a different imaginary in the face of climate change, where at a local level, economic activity 'would focus more on quality of life, the provision of good, wholesome food and time for family and friends, rather than on economic growth per se' (North & Longhurst, 2013, p. 1425). The movement thus has parallels with degrowth initiatives, GIY, slow food and slow city movements. This is also a tacit critique of resilience discourses which foreground the maintenance of existing systems in terms of 'bouncing back' from climate crisis (Pelling, 2011), in favour of 'bouncing forward' to an alternative socioeconomic paradigm (North & Longhurst, 2013, p. 1425).

Local currency change experiments have assisted in rethinking how local economies can be transformed from those dependent on surrounding areas, to relative stability and autonomy. They can also alter the dominant ideology of neoliberal capitalism. By transforming denominations of coins and notes into, for example,

hours of labour, alternative currencies can alter discourses of capital, challenging its assertions that money is to be controlled by states and banks alone (North, 2007, 2010). There is thus a wider political economic context to the development and spread of alternative currency forms. This context reveals that money itself is a discourse with a set of shared meanings and understandings, usually dominated by capital. A reworking of the discourse is thus possible when our traditional understandings of money creation, distribution and control are challenged by alternative currency practices (North, 2007).

In terms of urban transition, the borough of Brixton in London offers an example of how the Transition movement can act with some success in challenging and complex urban environments through the introduction of a local currency. Indeed, the introduction of the 'Brixton Pound', attested to the way in which the Transition movement can scale up from rural areas to urban ones. The success of this initiative 'challenges such imaginaries and the preconception that small towns and their hinterlands provide a more productive space for prefigurative politics than larger, more complex metropolitan spaces' (North & Longhurst, 2013, p. 1431). Notwithstanding issues such as the currency not being linked to banking, credit and taxation systems, and therefore not becoming an extensive currency for radical autonomy of the borough, it nonetheless revealed that radical experiments can encourage a positive economic localism and concomitant sustainability practices. Thus, the success of the Brixton pound has been beyond the economic dimension, fostering community building and social inclusion (North & Longhurst, 2013, p. 1432). This case reveals that rather than the discourse of there is no alternative, complex urban areas can be supported in transition movements to more sustainable and socially progressive paradigms in the face of necessary and inevitable changes due to climate change. Indeed, this example reveals that in actually existing urban Transition movements 'experiences in Bristol, Liverpool, Nottingham and Sheffield show that economic development agencies can engage in a politics of Transition' (North & Longhurst, 2013, p. 1435).

Indeed, the cities of Graz in Austria, and Freiburg in Germany reveal how civic engagement with interested stakeholders can foster transformative practices. In the case of Graz, the city was afflicted by low air quality due to industrialisation, which after the "smog winter of 1988/89" raised such public outrage as to pressurise the city administration into action (Rohracher & Spath, 2014, p. 1420). This coincided with a group of engaged citizens who were exploring broader ecological and energy dimensions in the urban setting. This movement expanded to incorporate a number of strategic actors from political, research and administrative areas. Thus, opportunities arose to exert pressure from within administrative departments to foreground environmental concerns and provide input into environmental policy in the city. From this emerged a number of environmental initiatives, including membership of the 'Climate Alliance of European Cities', which pledged a 50% reduction in GHGs between 1987 and 2010 (Rohracher & Spath, 2014, p. 1420). It switched to district heating, increased share of renewables including solar, and actively participated in competing for ecological awards. Indeed, such awards became important as they drew positive public attention to the city, setting up 'success stories for politicians' along with 'public appreciation of the eco-city identity' (Rohracher & Spath, 2014, p. 1421). Not unsurprisingly however, the encroachment of neoliberal ideology has somewhat stymied the progress of the city, where 'the eco-city image was replaced by new brands and visions like "cultural capital" and "city of design"' (Rohracher & Spath, 2014, p. 1421). Along with this, the 'energy market liberalisation' at the more macro national and EU level involved the privatisation of portions of public utilities. This removed power from the local municipality to operate as active decision makers in the energy

system of the city (Rohracher & Spath, 2014, p. 1421). Thus, whilst progress has been made in Graz, broader policy can interfere with progressive movements such as district heating and energy efficiency initiatives.

Whilst the city of Graz exemplified how civic engagement and strategic actors can influence urban planning, the city of Freiburg exemplifies how reaction to a perceptually 'negative' energy decision can also mobilise the public imaginary in favour of cleaner energy mixes. Thus, the ecological development of Freiburg was not so much to act on public pressure, but 'much more driven by the ambitious vision to reduce the dependence on what were increasingly perceived to be dangerous energy sources: coal and nuclear energy' (Rohracher & Spath, 2014, p. 1422). Thus, the demands for energy transition were rooted in desire and demand for a transition to a cleaner energy source. Moves included a decision to move the energy mix such that there was a zero share of energy from nuclear, introducing stringent standards on buildings insulation and the inclusion of a 'passive house standard' which would reduce heating demand to 15 kWh per square metre per year (Rohracher & Spath, 2014, p. 1423). Some of their public utilities which had been privatised have been bought back and are now in public ownership, revealing the potential for 'regime variations' at a local level, once again, counter to the hegemonic privatisation policies of neoliberalism (Rohracher & Spath, 2014, p. 1426). Such regime variations reveal that spaces exist for so-called radical or utopian spatial and ecological configurations to emerge in the public and urban contexts.

Indeed, a significant turn to remunicipalisation has emerged in utility provision globally, particularly with respect to water (Pigeon et al., 2012). From the global North in areas such as Paris, France and Hamilton, Canada, to Malaysia and Tanzania, a significant move to reinstate water into public control has emerged. The case of Paris is particularly surprising given that two major global water companies Veolia and Suez, are French companies and had long-standing contracts with the city. However, in 2008 their contract was not renewed and a municipally-owned utility was created in their stead (Pigeon et al., 2012). Whilst long-term success is to yet be assessed, the first few years have suggested that the remunicipalisation has succeeded, with a saving to the city of approximately €35 million, and a corresponding reduction in tariffs for end users (Pigeon et al., 2012, p. 25). The previously fragmented private system was made more efficient and sustainable, revealing a 'revived water resource protection' and awareness of sustainability (Pigeon et al., 2012, p. 25). Likewise, in Hamilton, Canada, a municipal decision was taken not to renew the water services contract with a private company, having witnessed failures in workforce rationalisation, the reorganisation of a co-operative local partnership into ownership by a multinational entity, water quality and poor maintenance of infrastructure (Pigeon et al., 2012, p. 80). Following remunicipalisation, staff were hired to counter the previous rationalisation, water quality improved, and savings to the city accrued (Pigeon et al., 2012, p. 83).

These examples serve to challenge the neoliberal ideology that market-based utilities provision are more efficient than public utilities. Indeed, many municipalities are 'frustrated with the broken promises, service cut-offs to the poor, the lack of integrated planning, and pressures from international financial institutions that force them to contract out to private firms' (Pigeon et al., 2012, p. 9). They are therefore motivated to reject privatisation, or where it has occurred to remunicipalise. Such moves to remunicipalisation thus serve as a 'new counter-narrative to the neoliberal ideology of market-based service delivery solutions' (Pigeon et al., 2012, p. 9). Therefore, whilst it may be difficult to restore privatised assets back to the public domain, remunicipalisation projects reveal that if planned correctly, it is not only possible but

preferable to privatisation of utilities. Indeed, a growing concern not just for 'efficiency' in services, but for social and environmental concerns has led municipalities to be critical of privatisation of utilities, rejecting economic and financial 'efficiency' alone in favour of a more holistic notion of public service which accounts for social and ecological wellbeing (Pigeon et al., 2012, p. 10). Thus, the role of public planning is key in asserting counter-narratives to the market logic of service provision.

10. Conclusions

10.1. Reprise of the work

This article has analysed selected international, regional (EU) and national (IE) policy documents, with the intention of functioning partly as a critical overview for policymakers and planners. It analysed these documents using the concept of the 'techno-finance fix', which, similar to spatial or temporal fixes, merely shifts crisis points in space or time. However, some positive aspects were also revealed, particularly through NGOs and to an extent at the EU level. Such discourses foregrounded ideas of wellbeing, sufficiency and the circular economy, whilst stressing the need to plan holistically and beyond siloing of policy. The analysis therefore reveals tensions between the requirements to mitigate environmental crisis, live well within ecosystem limits, while keeping the accumulation of capital uninterrupted. It problematises this contradiction in the contexts of planning for climate change, revealing that, despite the warnings of various policy documents that 'business as usual' cannot continue, and indeed is impossible on a significantly warmer planet, policy is framed within a growth trajectory. Thus, the fixes and solutions to ecological crisis are couched in terms of the greening of the global capitalist economy, with technology and finance playing key roles as fixes. The assumptions of these fixes assume a continuation of the 'structured coherence' afforded by fixes to allow accumulation to continue (Castree & Gregory, 2006).

The analysis of international policy describes a landscape where climate change and ecological crisis are largely understood and accepted. However, the solutions are most well defined in terms of technological fixes that are developed and brought to fruition using market mechanisms and financial instruments. It was observed that despite the market bringing about a 'renaissance of coal' and its concomitant emissions rate increase, the same market was deemed the best and sometimes only way to ensure the most ecologically sustainable fuel mix in the future. Thus, the 'techno-finance fix' emerged as a dominant discourse at that level.

At a regional (EU) level, some critique of compound capital accumulation was observed. In the European context, issues surrounding the financial measurement of ecological goods were emerging. Given that the EU is seen as the most progressive region for tackling ecological crisis (Jordan & Adelle, 2012), this is perhaps to be expected, as the region experiments with ways to create transitional instruments to not cause economic shocks whilst implementing fiscal measures to curb emissions.

As a member state of the EU that is requesting dispensation for emissions, Ireland is a significant actor in discussions of climate change, in that it potentially acts as an exemplar of how states may shirk or defer responsibility for emissions. The Irish case reveals a lack of policy integration, a 'siloing' of ecological matters between policy departments, and a failure to acknowledge that dealing in relative measures of emissions are at odds with the bottom line of real pollutants. This analysis shows that significant economic sectors can be led at a policy level towards practices of intensification that have knock-on effects on other sectors. Thus, the intensification of agriculture impacts transport, whereas the intensification of ICT services impacts on energy use.

Any recommendations for planning that draw from this analysis must be acknowledged to be hamstrung by the overall policy landscape from the top down, which is, as demonstrated, based on the premise of continued economic growth. Notwithstanding this, there exists a glaring need for more policy integration between ecological policies, fiscal, planning and economic policies. Examples of the Transition movement in Brixton, energy transitions in Graz and Freiburg, along with other grass-roots movements such as the GIY movement reveal that the hegemonic discourse of the 'rational actor' is not total. The 'Copenhagen Theory of Change' also reveals the potential for a grounded utopianism to develop given the correct configurations of support from planning. The reality is that climate change is 'reconfiguring urban politics and it is critical that neoliberal anticipatory elites are not able to exploit the urban future as a basis for controlling the metropolitan present' (Whitehead, 2013, p. 1364). Thus, just as there exist various climate pathways, so do there exist 'planning pathways' that can either tread the path of the fixes, including the techno-finance fix, or to take alternative paths to ensure a sustainable, prosperous transition that supports societal wellbeing over profit-making. Whilst these pathways are untested and unchartered, their potentials require acknowledgement and consideration. This article thus concludes below with a short commentary on one such set of pathways.

10.2. Fixing the fixes?

The concept of the 'techno-finance fix' describes the intensive dovetailing of technology and finance as drivers of the so-called 'green economy'. The concept is meant as a critical device that acknowledges that the maintenance of the existing economic status quo is a dominant discourse that holds implications for planning. It also implies that the 'techno-finance fix' is set firmly in a paradigm of compounding accumulation. However, as Harvey's work has revealed, the notion of a fix is temporary, and merely moves around the crisis issue rather than resolving the underlying contradictions that are inherent in the capitalist economy. Therefore, the 'techno-finance fix' can be critically appraised as likely to defer at best, the multiple, complex and 'wicked' problems of planning for climate change. However, unlike prior economic situations where capital could find alternative temporal and spatial outlets to 'fix' crises, the issue of climate change is substantively different, with a dearth of both space and time to 'fix' the issue in such a way as to allow unfettered and compounding accumulation to continue. There is thus a pressing need for a deep and profound acknowledgement of these contradictions at the level of policymaking and planning. If cumulative, compounding growth can be critically assessed as being inherently crisis-prone and requiring frequent 'fixes' to defer contradictions, we can begin to rationally apprehend the scale of the tension between the system that requires expansion, and the ecosystem which has finite sinks and resources.

In this context, the idea of a 'techno-finance fix' critically reflects an aspect of how the current economic system is reconfiguring around 'fixes' rather than the resolution of contradictions that now encroach beyond the economic and social, but to the very viability of human existence. It is thus meant as a critical device whereby policymakers and planners can become aware of not only the spatial and temporal fixes in operation, but the intense interrelated technological and financial apparatuses that are offered by the existing system to merely delay and divert ecological crisis. In the case of economic crisis, a 'fix' can emerge that can restore economic stability. It is far more unlikely that such fixes can work on the level of the ecosystem. Thus, the techno-finance fix potentially diverts the economic costs of climate change, in part through financialised incentives to invest in EM technologies.

However, given our existing understanding of fixes, it is naive to suggest that it resolves the materiality of ecosystem crisis. Such a fix is evident in carbon market schemes, where, as the material level of CO₂ in the atmosphere is rising, the fix is in the abstract realm of finance, dovetailing with aspirational and non-existent technological fixes such as BeCCS. Thus, the techno-finance fix shifts responsibility for carbon around the market, it potentially incentivises pollution, is subject to scrutiny by a volatile financial system, and places carbon management in the hands of 'technological dreamware'.

This is a key point in the context of early moves towards serious decarbonisation. Whilst an agreement has been reached on GHG emissions reduction at COP21 in Paris, this article has pointed out that the moves are inadequate to the task. It is therefore potentially the case that the policy and planning landscapes may shift significantly as scientific models gain more accuracy and can more granularly reflect how the new climate policies are performing. Thus, the area of decarbonisation is in flux. Potentially, the techno-finance fix can operate until such time as their results are not in line with projected emissions reductions. This places the area of decarbonisation as a likely site for tensions around the techno-finance fix, scientific modelling, policy and planning.

It is thus key that policymakers and planners investigate, and indeed plan beyond fixes that emerge from within the system. Whilst it has become normative to consider the economic aspects to climate change, and to justify action based on economic logic, it is important to acknowledge that 'eco-restructuring' is not necessarily socially or ecologically progressive (While et al., 2010). Indeed, under the current conditions of neoliberal capital, it is arguably the case that the 'techno-finance fix' or fixes that are proffered, merely amount to hubristic and over-optimistic projections on solutions. When dovetailed with EM theories, the current market logic makes matters such as climate change more 'tractable' whilst also overlooking 'the extent to which climate change can be dealt with without a change in social values or in society-nature relations' (Newell et al., 2013, p. 86). Such paradigms also underestimate 'the consequences of a growth logic that may ultimately be fundamentally incompatible with dealing with climate change' (Newell et al., 2013, p. 86).

If it is therefore accepted that the 'techno-finance fix' is merely an exercise in shifting the ecological crisis around, the domains of planning and policymaking also need to become proficient in assessment and critiques of alternate paradigms. It is suggested here that the most likely area for strong intervention is in the area of decarbonisation, and may be the site of considerable policy attention. It is again naive to suggest that capital can necessarily survive the requirements of climate change to adapt carbon-intensive lifestyles (Harvey, 2014; Wainwright & Mann, 2012). The planning and policymaking domains therefore need to be proficient with the matrix of possibilities under existing conditions, and open to the possibility of conditions that are not yet emergent.

Even if the current mode of capitalist production can continue under constraints of climate change, there exist a number of configurations. One can be considered as potentially in the form of a 'climate "Leviathan"' with connotations of man's dominance over nature, and the continuance of the economic status quo, with a planetary sovereign to the fore who can act as an arbiter for control of carbon and other ecological matters (Wainwright & Mann, 2012). A second configuration exists as a reactionary 'climate "Behemoth"', in the form of either a reactionary populism, or an anti-state democracy, that rejects the idea of a planetary sovereign (Wainwright & Mann, 2012, p. 13). The first configuration throws up obvious issues of global hegemony. It also raises questions regarding geoengineering, population control and loss of

sovereignty as, for the sake of capital, the ecosystem and all populations therein, are reconfigured under the auspices of a 'sovereign' who takes charge of the task. The second configuration is equally problematic, as in the rejection of a planetary sovereign, geopolitical instability in the face of a changing climate has connotations of uneven destabilisation of regions, conflict, social unrest and general hostility.

If the current mode of capitalist production is found to not be viable under constraints of climate change, there similarly exist a number of uncharted configurations. Whilst the doctrine of 'there is no alternative' marginalises debates about a non-capitalist or post-capitalist future, the stresses of climate change adaptation and mitigation may very well hinder the production of surplus to the extent that capital cannot continue to accumulate. If this is the case, a number of configurations are possible. The first possibility here emerges as a 'climate "Mao"', which places the idea of a planetary sovereign to the fore, but is directly against capital for the sake of the future collective species' (Wainwright & Mann, 2012, p. 9). The second possibility emerges as 'climate "X"', a formulation which is both non-capitalist and rejects the notion of a planetary sovereign (Wainwright & Mann, 2012, p. 15). Whilst it is difficult and indeed unwise to predict how these configurations may work in practice, it is at least crucial that the discourse is widened to argue for the possibility of these configurations.

Climate Mao may appear as unlikely as a Climate Leviathan, from the practical standpoint of gaining universal consensus to abandon capitalism for the sake of the future. The scale of mobilisation and agreement required to transition to 'no-growth' or 'degrowth' paradigms seem aspirational. Yet, the possibility requires acknowledgement at least as a counter to there is no alternative. Likewise, the Climate X configuration is similarly idealistic, yet also requires acknowledgement for its potential to offer a planetary configuration that is non-capitalist and non-hegemonic. The dovetailing of top-down policies with ground-up local initiatives could make such a configuration more possible. A shift from the focus on global capital to local, alternative and non-market initiatives can move policies and planning decisions towards sustainability.

It is important to acknowledge that discourses of local and planetary potentials beyond capital are radical, aspirational, hubristic and untested.

However, the same holds for faith in the 'techno-finance fix'.

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Trish Morgan is a lecturer in multimedia at Dublin City University. She is also an associate member of the National Institute for Regional and Spatial Analysis (NIRSA) at Maynooth University. Her current research is in a PI role on an Environmental Protection Agency (EPA) funded research project that centres on the political economy of the media and cultural industries, and their role in fostering discourse and behaviour change around consumption practices and ecological sustainability. Trish holds a PhD in Innovation in Digital Media Production from Dublin City University. She formerly worked in IT networking and security for two Fortune-500 companies.